




Division 8000

No longer the 'California Lab'



IT USED TO BE CALIFORNIA LABORATORY DIVISION 8000. Its work was mostly accomplished in the facilities on the lovely, compact campus in Livermore, California, as seen in the photo here. But when researchers are scattered far afield, calling the division “the California lab” doesn’t tell the whole story. From Alaska to Carlsbad, Division 8000 researchers are advancing science and engineering in fields from energy to climate to strategic deterrence. Now Associate Labs Director Dori Ellis and her colleagues in Div. 8000 are seeking a new, more descriptive name. Read about the division’s impressive mission portfolio in a story on page 5.



Meet Dori Ellis

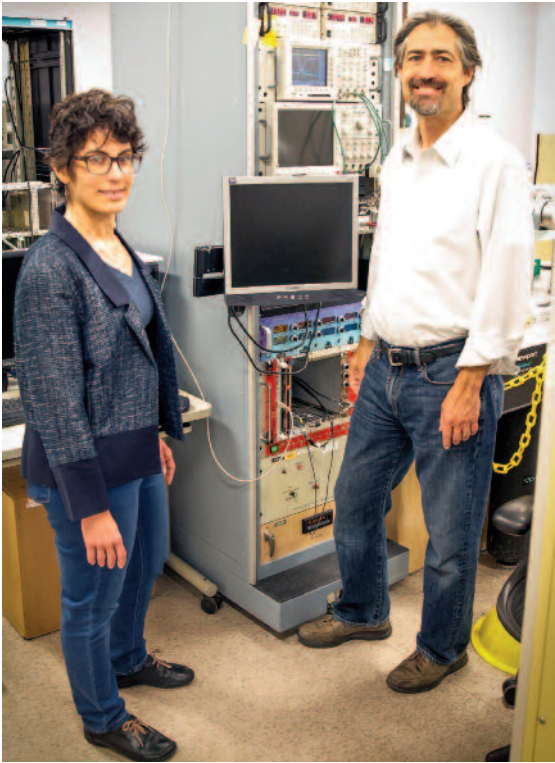
New Div. 8000 Associate Laboratories Director says the chance to return to Sandia after ‘failing at retirement’ is capstone of her career. Find out what moves, motivates, and inspires her in a Q&A on page 6.

World’s smallest neutrino detector finds big physics fingerprint

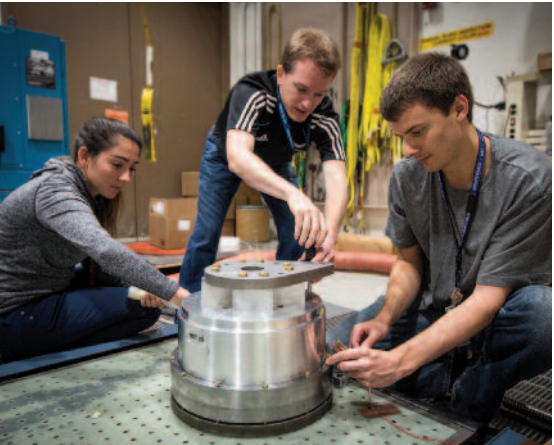
Sandia plays key role in experiment to measure coherent elastic neutrino-nucleus scattering
By Michael Padilla

Sandia researchers have helped solve a mystery that has plagued physicists for 43 years. Using the world’s smallest neutrino detector, the Sandia team was among a collaboration of 80 researchers from 19 institutions and four nations that discovered compelling evidence for a neutrino interaction process. The breakthrough paves the way for additional discoveries in neutrino behavior and the miniaturization of future neutrino detectors. Neutrinos, elementary subatomic particles with infinitesimal mass and with no electric charge, are extremely challenging to detect. The COHERENT project was led by DOE’s Oak Ridge National Laboratory (ORNL). The research was performed at ORNL’s Spallation Neutron Source (SNS) and has been published in the journal *Science* titled “Observation of Coherent Elastic Neutrino-Nucleus Scattering.” The research team was the first to detect and characterize coherent elastic scattering of neutrinos off nuclei. This long-sought confirmation, predicted in the particle physics Standard Model, measures the process with enough precision to establish constraints on

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BELKIS CABRERA-PALMER, left, and David Reyna were instrumental in the COHERENT collaboration. (Photo by Michael Padilla)



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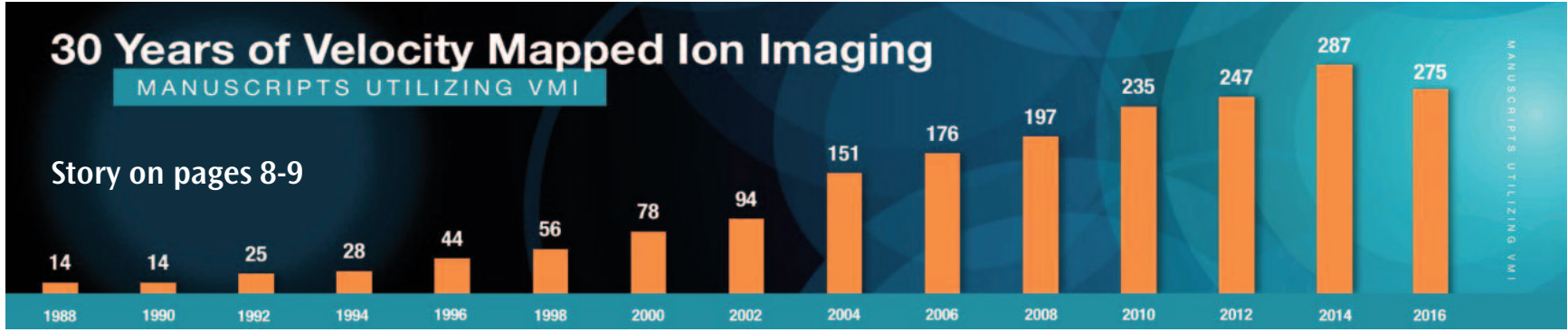
Sandia/California



Gives Back

A SNAPSHOT OF GIVING BACK at Sandia/California

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That’s that

By Kayla Norris (8151)

When the job opportunity with Sandia National Laboratories in Livermore, California, came up, I had been working at Los Alamos National Laboratory (LANL) for about six years. I vividly remember discussing the Sandia job with one of my former mentors at LANL. He knew the area well. He asked me “Have you ever been to Livermore?” I had, once for my interview, and a few times to San Francisco. I especially enjoyed my visits to San Francisco. His next question was, “So you know that Livermore isn’t anything like San Francisco, and it’s at least an hour’s drive, without traffic?” My answer was, “Well, no, and I’ve already accepted the job offer.” Yikes!

Passionate native New Mexicans understand that New Mexico is truly an enchanted place. We love the breathtaking landscapes and sunsets, the local cuisine, the blended cultures and endless opportunities for adventure. Racing down a mountain on a bike or snowboard, rushing down a river, soaking in a secluded hot spring, or hiking the countless trails are just a few. In making the move to Livermore, those are things I thought I’d be leaving behind. But hardest of all would be saying goodbye to the people I call family – friends, co-workers, and neighbors – who made up my sense of community. Yes, there was a lot I’d miss about New Mexico.

My job duties would change significantly, coming from the Prime Contract office at LANL to working on budgets/financials for our Nuclear Weapons program at Sandia. I wasn't quite sure what to expect in California or how it would compare to my work environment at LANL. What opportunities existed for adventures outside of work? My journey would begin and I’d see where it took me.

During the nearly two years I’ve worked at Sandia in Livermore I’ve found that there are more similarities than differences. Sure, being managed by different M&Os, a few systematic and procedural differences were expected. Also, I’ve immersed myself into a new world of budgets, financial tools and systems, and future years’ budgetary planning, all while operating under a Continuing Resolution.

I continue to learn and engage as much as possible on the technical side of the work that I provide financial support to. It’s quite fascinating to learn about and physically see some of the innovative technologies that are developed at Sandia.

The Livermore campus has a very similar feeling to the small and intimate liberal arts college, Regis University, I attended for my undergraduate studies. Regis’s values were rooted in “developing the person as a whole and becoming part of something bigger than ourselves.”

The Livermore campus promotes work-life balance while offering options for flexible work schedules and various organized events and activities. A few of my favorites are: the monthly farmer’s market that has allowed me to support local vendors, and the 5Ks and monthly miles that promote physical health and wellness. Additionally, I enjoy the group fitness classes taught by exceptional instructors. Participating in these various organized activities has continued to further my personal and professional development along with establishing relationships with staff and colleagues.

Overall, I’ve experienced a very welcoming and supportive work family since day one. Similar to LANL, I've had the privilege to work with business and technical colleagues as well as managers who remain passionate about their work. We are all impacting Sandia’s purpose “to develop advanced technologies that ensure global peace.”

While red or green is usually only an option for my salsa choices at the local taquerias, the diversity in Bay Area food choices continues to surprise my palette. In my time outside of work, I’ve found endless miles of hiking and mountain biking trails with coastal views, giant redwoods and sequoias, mystical fog that settles all around, and yoga sessions in the vineyards and barrel rooms of local wineries.

Living in the Bay Area has allowed me to experience a different kind of beautiful while contributing to the safety of our nation and helping ensure mission success.



KAYLA NORRIS



Sandia/California Gives Back

Every year, Sandians make a positive impact on the communities where they live and work. Check out the highlights of our 2016 giving below.

501 toys

TOYS FOR TOTS

Operation Backpack

65 backpacks full of school supplies to children of military families

Holiday Spirit Gift Campaign

310 Gifts to Children



1,000 lbs of food to:

- Livermore Valley Hunger Coalition
- Interfaith Sharing, Livermore
- Interfaith Ministries, Tracy
- Second Harvest, Manteca



SHARE

8,000 hours volunteered

\$210K

donated to non-profits via employee giving



Veterans Book Drive

725 books to local VA hospitals



One Warm Coat

220 Coats

to Family Life Center at Tri-Valley Church of Christ



Make a Difference Day

75 pounds of tomatoes picked

35 metal posts pulled out of the ground

MAKE-A-WISH

\$5,132 donated | 40 items donated

Silent Auction

Join your fellow Sandians in being of service to our communities.

Go to community.sandia.gov

Exceptional service in the national interest

Sandia LabNews



<http://www.sandia.gov/news/publications/labnews/>

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California team edits annual Lab News California edition



Jules Bernstein, Michael Padilla, Madeline Burchard, and Patti Koning (all 8524) share a light moment after stepping in as editors of this, the 11th annual issue of the *Sandia Lab News* featuring stories from Sandia’s California lab and beyond. Special thanks to Krissy Galbraith, Loren Stacks, Randy Wong, Dino Vournas, Emmeline Chen, and Jana Cuiper for all their contributions and assistance to the issue.

(Photo by Krissy Galbraith)



Science and engineering event for everyone

Sandia interns showcase work at 'Posters on the Patio'

By Michael Padilla • Photos by Krissy Galbraith

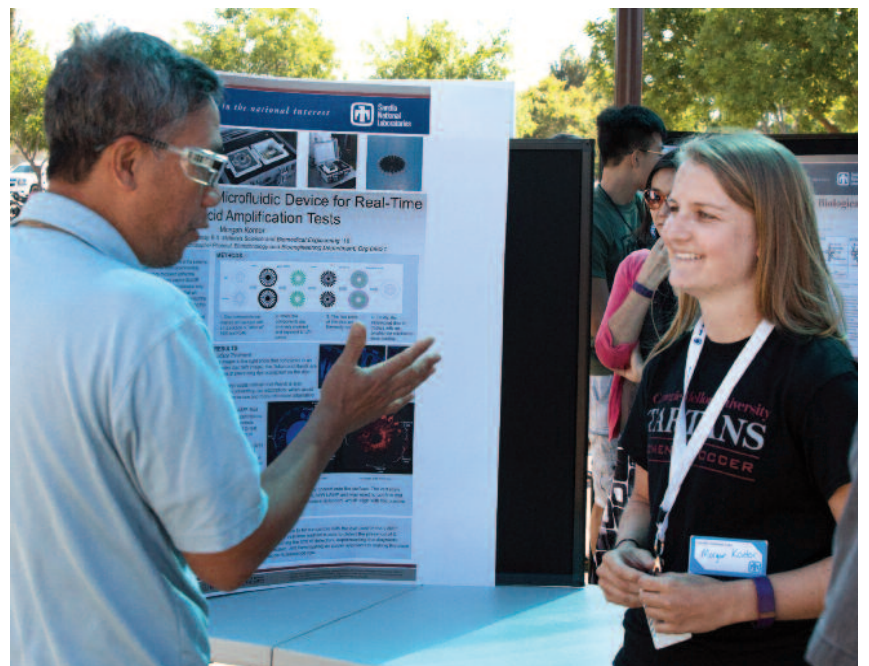
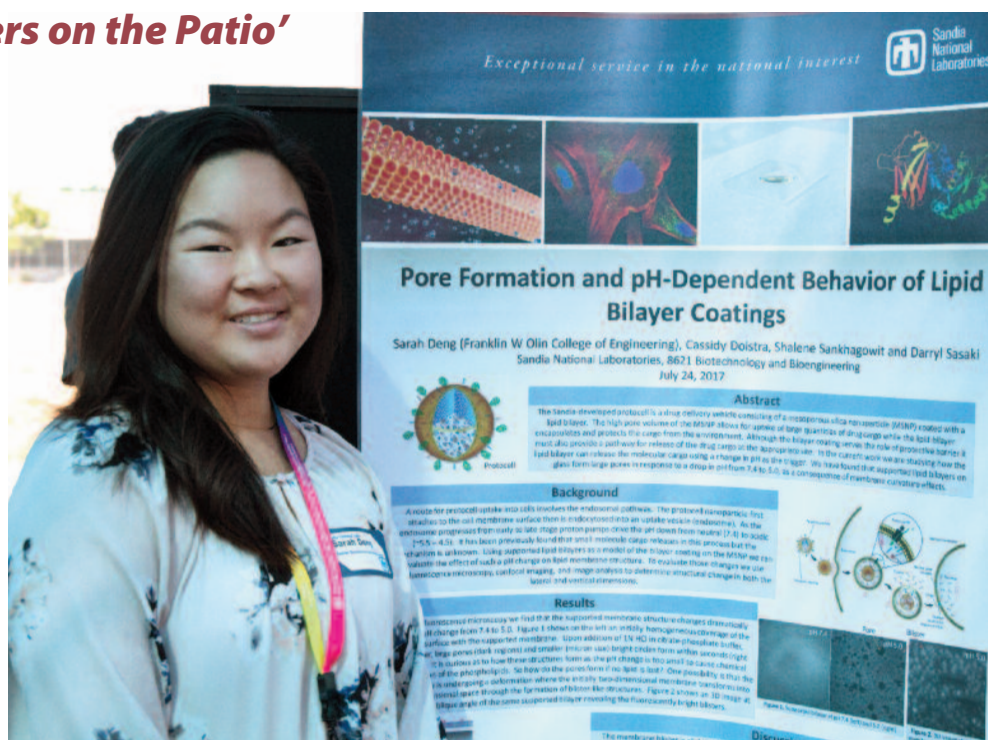
This year's annual Intern Poster Symposium, "Posters On the Patio," showcased 61 posters and encompassed more than just posters describing intern projects at Sandia, California.

Student Intern Programs partnered with Division 8000's Vision 2020 "Nourishing Community" team to create "Science and Engineering for Everyone." The event provided an opportunity for Sandians to invite family and friends to learn about cutting edge research at the site, and to connect with each other and their peers.

"The event provided an opportunity for student interns to reach a broader audience, as well as to share insight into the work that is being done at Sandia," says intern program coordinator Nicole George (8522). "The intent of the event was to provide a fun-filled and educational experience while encouraging the members of the workforce to engage with the Sandia community."

The event also featured interactive booths from Family Science Night, multiple activities highlighting work done throughout Division 8000, and a presentation by Nick Williams from Lawrence Livermore National Lab's Discovery Center, titled "Fun with Science."

This summer, Sandia's California Lab hosted 139 interns.



Div. 8000 in forefront of cutting-edge weapons work

W80-4 LEP, Mk21 Fuze Replacement modernization programs on-time, on-budget

By Michael Padilla

The W80-4 Life Extension Program (LEP) and the Mk21 Fuze Replacement program, both led in Div. 8000, have a shared commitment to on-time and on-budget delivery in support of Sandia’s nuclear weapons mission and in accordance with customer requirements.

Center 8200 Director Mike Hardwick says both programs are on track to achieve these goals, meeting all scheduled milestones to date, enabling the nuclear deterrent to function, and improving the safety, security, and reliability of the nation’s nuclear weapons stockpile.

“The California-based weapon modernization programs represent a significant investment of financial and staff resources,” Mike says. “We work closely with our New Mexico colleagues, our partners across the nuclear weapons enterprise, and our customers to ensure successful planning and execution.”

The W80-4 LEP and Mk21 Fuze replacement program are two of four major modernization programs being carried out at Sandia, with the other two being the B61-12 LEP and W88 ALT 370. Together, these efforts represent the largest nuclear weapon development investment at Sandia in decades.

W80-4 LEP

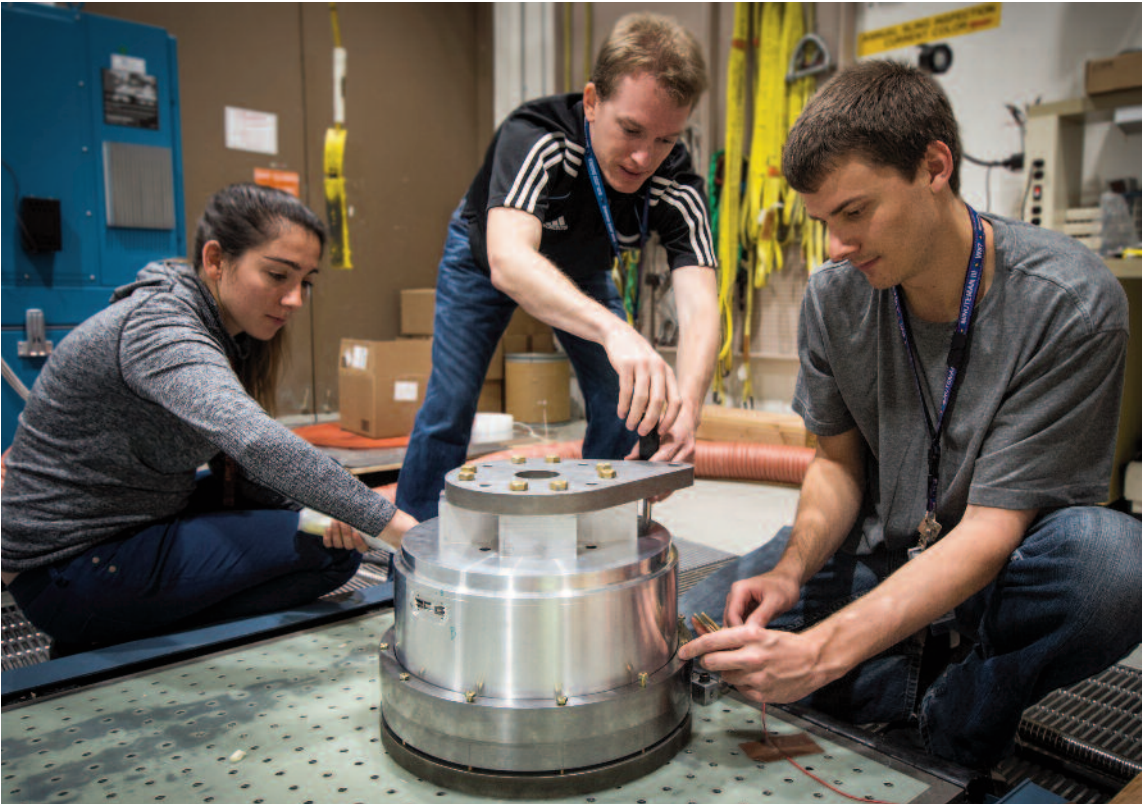
The W80-4 LEP is a high-impact program that is expected at its peak to employ up to 500 workers at Sandia. Over the 10-year period from initiation to First Production Unit, which is slated for 2025, the program will follow the 6.X process as established by DOE and DoD.

In July 2015 the program was approved to enter the feasibility study phase, Phase 6.2, which involved tremendous growth in terms of staff, partnerships, and design development.

Paul Spence (8420), acting senior manager overseeing W80-4 Weapon System Engineering organizations, says the W80-4 team counts among its accomplishments the establishment of three system engineering departments — two in California and one in New Mexico, the initiation of 23 product realization teams, implementation of risk review and engineering review boards, and progression of requirements and qualification planning.

“As we begin transitioning to the design definition and cost analysis portion of the program, Phase 6.2A, our team is focused on preparing for the WDCR — the Weapon Design and Cost Report — which is a key deliverable due in the third quarter of FY18,” says Paul.

The W80-4 team is supporting the WDCR process with a major scheduling and cost analysis initiative. Additionally, the team is preparing for full Earned Value Management System (EVMS) implementation



W80-4 SYSTEM STAFF AND COLLEAGUES in electrical sciences review assembly procedures in preparation for testing. (Photo by Loren Stacks)

much sooner than other development programs have in the past. EVM is a highly structured work assessment process that tracks work completed and budget spent against a plan, and is on track to be launched in late FY18.

EVMS implementation is one of the new requirements imposed on current weapon modernization programs by NNSA, the W80-4 program’s key customer. NNSA has also established new requirements for Nuclear Enterprise Assurance (NEA) designed to ensure resilience to adversarial subversion of the warhead design and supply chain.

The goal of the W80-4 program is to refurbish the W80-1 warhead, which involves replacing aging components to extend its life. Sandia is responsible for the development of non-nuclear components and subsystems, while Lawrence Livermore National Laboratory is responsible for the nuclear explosive package. Together, the two laboratories share the overall design responsibility for the warhead and have established a close partnership.

The W80-4 warhead is being integrated with the Long Range Stand-Off Missile (LRSO). NNSA is responsible for the W80-4 development program and the US Air Force is responsible for the LRSO development program. These programs are being conducted in parallel, with the development and qualification activities between NNSA and DOD carefully coordinated.

The Air Force intends to select two independent missile contractors to work on separate designs. With selection now imminent, the W80-4 team is preparing to support development of the two designs over the program’s 4.5-year Technology Maturation and Risk Reduction (TMRR) phase.

Paul attributes the accomplishments of the program to date to the committed group of talented staff and the strong partnerships developed with the many contributing organizations across the Labs, as well as the program’s production agency partners.

“We have brought together a diverse team of scientists, engineers, and programmatic staff to meet the challenges of this complex program,” Paul says.

Mk21 Fuze replacement

Sandia’s on-going work on the Mk21 Fuze Replacement program continues to be an instrumental activity for the Laboratories. The fuze is an Arming and Fuzing Assembly (AFA) that assembles into the Mk21 reentry vehicle and interfaces with the W87 warhead. The reentry vehicle is deployed on the US Air Force Minuteman III intercontinental ballistic missile (ICBM).

This Air Force program is built on Sandia’s decades

of experience in providing arming, fuzing, and firing systems for US Navy submarine-launched ballistic missile warheads. The Mk21AFA arms and triggers the warhead at a pre-determined point in flight.

Curt Nilsen (8250), senior manager of the Mk21 Fuze and Science Enabled Engineering group, says Sandia is

responsible for designing the components of the Mk21 replacement fuze that must survive against adversarial defenses and a variety of other challenging environments.

“Sandia team members working on the Mk21 Fuze Replacement program continue to focus on product requirements and qualification activities,” says Curt.

“Qualification activities are key in demonstrating component and system perfor-

mance to ensure program success.”

Sandia has been working on the Mk21 Fuze Replacement program since 2011 and has met all scheduled deliverables to the Air Force, Curt says. The program has conducted numerous environmental tests and is preparing for a flight test next year. Curt says the program is on track to meet the goal of creating the first production unit in 2022, with production expected to continue until 2029.

Sandia’s longstanding and productive working relationship with the Navy was a strong factor in the Air Force selection of Sandia to design the replacement Mk21 fuzes, Curt says. Contracting with Sandia also created the opportunity to gain efficiencies by leveraging commonalities between the Air Force and Navy fuzes through the W88 ALT 370 program. The program follows the NNSA Phase 6.X NW development process instead of the Defense Acquisition Process (DoD 5000 process) historically used by the Air Force.

“The Air Force has been pleased that Sandia has met all deliverables and has been complementary of the successes we have made to date,” says Curt. “The Air Force recognizes that Sandia is able to save taxpayers’ dollars by leveraging our work with the Navy. In addition, significant costs are avoided by not having to create separate production facilities and associated assessments.”

The Mk21 Fuze program is led by Science Enabled Engineering Org. 8250 and relies heavily on team members from across Sandia, especially in Divisions 2000 and 5000. The program has also used modeling and simulation tools developed by the Advanced Simulation and Computing program.

“I am pleased with teaming across Sandia and it’s encouraging to work with a group of people who are committed to meet the needs of the Air Force and the nation,” Curt says. “The success of the Mk21 Fuze Program is attributed to the commitment from a wide spectrum of individuals from throughout Sandia.”



RINGDOWN TEST OF THE MK21 AFA — Ringdown evaluates the time RF energy lingers in the RV body section immediately after a transmitted radar pulse. This time describes a minimum radar fix distance to obtain a reliable ground proximity detection.

Division 8000: It's more than 'just' California now

The Waste Isolation Pilot Plant at sunrise. Sandia's WIPP team in Carlsbad, New Mexico, is now part of Division 8000.

By Patti Koning

Division 8000 has had a growth spurt. The May 1 transition to the Honeywell M&O contract added approximately 600 employees to the division, a result of consolidating energy programs.

“Consolidating our energy programs into one division makes it easier to focus on our energy customers and take advantage of the strong multiprogram roles that Center 8800, New Mexico Energy and Geoscience, plays,” says Division 8000 Associate Laboratories Director Dori Ellis.

In addition to moving programs and staff, the reorganization expanded the geographic footprint of Division 8000 to include the Carlsbad Programs Group; the Scaled Wind Farm Technology (SWiFT) facility in Lubbock, Texas; and two research sites in Alaska.

Keeping an eye on WIPP in Carlsbad

Sandia serves as science advisor to DOE's Office of Environmental Management (via DOE's Carlsbad Field Office) for the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico. To that end, Sandia maintains offices, computing platforms, laboratories, and other technical capabilities in Carlsbad.

WIPP is the world's only licensed and operating deep geologic repository for the permanent disposal of transuranic (TRU) waste. At WIPP, defense-related TRU waste streams are placed in excavations in ancient salt beds found 2,150 feet below the earth's surface.

Sandia uses a suite of computer models and codes — informed with fundamental work in geochemistry, hydrology, and rock mechanics — to estimate the cumulative releases of radioactive materials from the repository 10,000 years into the future. Called performance assessment calculations, these estimates must be generated at least once every five years in connection with the periodic recertification of WIPP by the Environmental Protection Agency.

Funded continuously since 1975, Sandia's WIPP work has evolved greatly over the years since the initial charge to characterize the site that became WIPP. “It could be argued that WIPP is the longest-running single project in Sandia history,” says Paul Shoemaker (8880), senior manager of the Defense Waste Management Programs group.

While about 50 workforce members live in Carlsbad, a far greater number have rotated through the site. Paul explains that most of the technical staff in Carlsbad start their Sandia career by working three to five years there before transferring to other Sandia locations.

Catching the wind in Lubbock



THE SWiFT site in Lubbock, Texas.

Less than 200 miles east of Carlsbad, Sandia is perfecting the art of capturing wind energy at DOE's SWiFT facility in Lubbock, Texas. Located at Texas Tech University's National Wind Institute Research Center, SWiFT is the first public facility to use multiple wind turbines to measure turbine performance in a wind farm environment. Current research focuses on wake steering: how to position wind turbines in a farm to maximize efficiency of the downwind turbines, which produce less energy than do upwind turbines.

“The S in SWiFT, which stands for scaled, is the most important characteristic of this facility. The cost difference is significant,” says David Minster (8821), manager of the Wind Energy Technologies department. “The turbines here are one-third the size of commercial turbines, but we can operate them at about 5 percent of the cost, so this really is a research facility. If

you've driven past a wind turbine, chances are SWiFT had some impact on its design.”

David Mitchell (8821) has been the facility superintendent for the past two years and is the first Sandian permanently located at SWiFT. Many other researchers travel to SWiFT to conduct research for periods ranging from a few days to a few months. “It's thrilling to conduct leading-edge wind research here,” he says.

An eye in the sky in Alaska



Climate research on Alaska's North Slope.

For the past 20 years, Sandia has maintained a presence in the nation's northernmost state, managing the North Slope of Alaska atmospheric observatory. This observatory is part of the Atmospheric Radiation Measurement (ARM) Climate Research Facility, a national scientific user center funded through DOE's Office of Science.

Working at two sites, Utqiagvik and Oliktok Point — both on the Beaufort Sea, the northernmost spot in the United States — Sandia researchers and partners from other national labs and academia collect data about cloud and radiative processes at high latitudes. This data is then used to refine atmospheric models.

“Sandia has provided a continuous longitudinal data stream from our atmospheric testing, available to scientists worldwide,” says Lori Parrott (8863), manager of the Atmospheric Sciences department.

Four Sandia contractors live year-round as observers at Utqiagvik, and four others work two-week stretches at Oliktok Point. From March to October, as many as eight scientists may join the observers for short stints to conduct research and maintain equipment.

Earlier this month, Sandia researchers flew a tethered balloon and an unmanned aerial system together for the first time to collect Arctic atmospheric temperatures with better location control than ever before. See the Aug. 4, 2017, issue of the *Lab News*.

“Everything is harder in the Arctic,” says Lori. “With extreme weather, soppy tundra, and mosquitoes, it's just more complicated up here. But this location also provides an extreme eye into a part of the globe where things are changing very rapidly.”

Developing biofuels in Emeryville



THE JBEI facility in Emeryville, California.

Another Division 8000 remote site is the Joint BioEnergy Institute (JBEI) in Emeryville, California, about 35 miles west of Livermore. Sandia has been a partner since JBEI was established in 2007 by DOE's Office of Science, along with Lawrence Berkeley National Laboratory, the University of California campuses of Berkeley and Davis, the Carnegie Institution for Science, Lawrence Livermore National Laboratory, and Pacific Northwest National Laboratory.

About 30 Sandians work permanently out of JBEI, and many

others split their time between Sandia's Livermore site and JBEI.

“This is a different type of multi-lab research center in that it is a unique facility housed under one roof, rather than located across partner sites,” says Ben Wu (8610), senior manager of the Biosciences Programs group. “This creates a very special synergy among the staff.”

JBEI's purpose is to advance the development of next-generation biofuels. Sandia is a key member of the Deconstruction and Technology divisions and contributes to JBEI's other three divisions: Feedstocks, Fuel Synthesis, and Sustainability. JBEI was recently selected as one of four DOE Bioenergy Research Centers to be awarded a total of \$40 million. This award extends JBEI's funding through 2022.

Seeking a new name for Division 8000

With one-third of the workforce located outside of Livermore and sites scattered from Alaska to Texas — not to mention the Division's role at places like the Strategic Petroleum Reserve in Louisiana and the 50 permanent telecommuting staff spread across the country — calling Division 8000 the California Laboratory has become a misnomer.

To reflect the Division's larger geographic diversity and broad missions, Dori is asking all members of Division 8000 to suggest names that encompass the new division's breadth and scope. Please email your suggestions to 8000-ALD-Office@sandia.gov.

“We oversee the energy and homeland security portfolios, but this Division touches every research area of Sandia,” says Dori. “We need a new name that encompasses all of the important work that is being conducted throughout Division 8000.”

Dori Ellis: Returning to Sandia ‘the capstone’ of my career

Interview reveals Div. 8000 Associate Labs Director’s hidden history, inspirations, motivations



‘LIVE YOUR VALUES’ — Dori Ellis says she is excited to take on her new role as Div. 8000 Associate Labs Director, a role she calls the “capstone” of her career. (Photo by Loren Stacks)

Labs News team members Jules Bernstein and Michael Padilla (both 8524) sat down recently with Div. 8000 Associate Labs Director Dori Ellis to find out more about her. She talked about stepping out of retirement to be part of the new Sandia management team, provided a glimpse of her early years growing up in Wyoming, and shared her admiration of history’s most influential women.

Lab News: We’ve read past interviews with you where you said you “failed at retirement.” Is that right?

Dori Ellis: Yes, I did. I think I made a mistake in retiring because it seemed like the right time, not because I was ready. I quickly realized that all those projects I lined up for when I retired were finished in 18 months. I was consulting for Lawrence Livermore National Laboratory at the time and Parney Albright, who was the director then, asked me if I’d consider coming to work for them doing business development. I decided to give it a try and moved to California. I’ve since asked myself why it took me so long to get here. We really have come to love

“I think that you have to live your values. If you have to ask yourself, ‘Is this an ethical thing to do?’ it probably isn’t.”

being in Livermore. It’s just a charming place to live.
LN: If you hadn’t come to Sandia, what else might you have liked to do with your career?

DE: One of my strengths is adaptability. So, I could have done a lot of different things. I grew up in a family-owned business and certainly could have gone down that pathway. I toyed with the idea of going into medicine or law. As a single mom going back to school, though, I recognized I had to get through. Engineering seemed like a good way to apply math and science skills and get through in a reasonable amount of time while making a good life for the kids.

LN: What has surprised you the most about being back at Sandia?

DE: Some things haven’t changed much. I think with an organization that has a culture as deep as this one, you wouldn’t expect rapid change. One of the things that has been a little surprising is the size to which we’ve grown. The increase in weapons programs really has been noticeable over the last five years. Sandia/California has grown tremendously in size. The complexity of the portfolio has increased as the size has increased. Having the geographic distribution of the current Division 8000 is also a little bit of a surprise. We have people in Alaska, Texas, Louisiana, and Albuquerque as well as in California — and not just in the Bay Area. We have people in Southern California as well.

LN: Do you have an overarching philosophy that tends to guide your decisions in life?

DE: I think that you have to live your values. If you have to ask yourself, “Is this an ethical thing to do?” it probably isn’t. Also, I think that often times you need to make decisions with limited information, act on them, check against the metrics that you use to make the decision, and then if it’s not working make some changes. It’s easy to become paralyzed. You know — more data, more data, more data. Of course, the flip side of that is if you make a decision on too little data you could walk

“The leadership of women who really didn’t have much voice inspires me. Their stories tell you that you can make big changes without having a forward position.”

off a cliff. But I think you’re often better off making a decision with time to correct it, rather than waiting and allowing the situation to be decided for you by default.

LN: Who inspires you and why?
DE: I’m a charter member of the National Women’s History Museum, which is coming together right now. It has received Congressional permission to seek a site, publicly funded, on the National Mall. It’s the last available site. When you look at the women who’ve been so influential in this country, they might be a footnote or they might not be mentioned at all. When you start looking at women like Vera Anderson, a welder in WWII, or Alice Coachman, the first African American woman to win an Olympic gold medal, or going back to people like Betsy Ross who probably didn’t create the first American flag, but was very influential in the Revolutionary War, it’s hard not to be inspired!

The leadership of women who really didn’t have much voice inspires me. Their stories tell you that you can make big changes without having a forward position. We need to, as an institution, as a country really, continue to take advantage of the differences that women and underrepresented minorities bring, because it really does give us a different voice.



DORI KEEPS FIT as an avid bicyclist.

LN: Is there one single accomplishment in your career or in your personal life that you’re most proud of?

DE: Coming back to Sandia as an ALD is such an amazing opportunity and the capstone of my career. That’s the thing I’m probably most excited about.

LN: What would you say is the best advice that you have ever received?

DE: Probably the single best bit of advice I ever received was this. If you’re unhappy with your situation, the only person you can change is you. If there’s something you don’t like, you’ve got choices. You can either quietly accept your situation, stay and complain about it, change your behavior, or change the situation by moving somewhere else. But ultimately, you’re accountable for your own happiness or unhappiness in a situation.

LN: What is your advice for achieving work-life balance?

DE: My husband and I have a blended family of five kids. And all of the kids were very active during their school days while they were still living at home, in college, and through graduate school. I wouldn’t say we were balanced exactly, but at some point you really do have to set some priorities, set some limits. And balance may not be the right word. It might be trying to reach equilibrium in some way over time. But you do have to take care of yourself. Be physically active. Be a learner. And be engaged — whether it’s your family or your church or your community, there’s more than just work.

LN: What are your hobbies?

DE: My husband and I would have said five years ago that we played a lot of golf. We’re not playing now. Instead, we ride our bicycles. I’m a voracious reader. I love historical fiction, love a good mystery. I’m not much on sci-fi, but my husband says I belong to the ‘clean plate club’ of reading. I’ll read almost anything.

LN: Do you have a favorite book or movie?

DE: I really liked *Ruska*, by Edward Rutherford. If you’re not a Russian history buff, it may be too much detail. It’s a history of four families that started 1,800 years ago in what is now Russia, and tracks their descendants all the way to the end of the Cold War.

LN: Do you see any parallels from the book to modern day life?

DE: Many! When I read the book, I was working in international security programs. We were doing a lot of engagement with the Russians, both the scientific community and the weapons community. It helped me to understand a little bit better where they were coming from. We’ve been very privileged not to have had a major modern war on our soil. During World War I and World War II, the Russians were devastated. They lost a massive number of their young men. It really has influenced their thinking relative to national security and defense of the homeland.

LN: Can you talk a little bit more about where you grew up, the early years?

“You do have to take care of yourself. Be physically active. Be a learner. And be engaged. . . . There’s more than just work.”

DE: I grew up in a tiny town in a central Wyoming oil-field. The sign coming into town said population 253. The town I grew up in... there were two towns, actually. There was a town of people that worked for “the company,” and then there were the contractors. My parents were contractors so we lived in the “other” town.

I went to a school where there were maybe 30 people in your grade level. I grew up in a very large family. I had seven siblings, five older sisters and two younger brothers. My dad was absolutely old school. He was first generation born in this country, of German origin. He really believed that men and women had different roles. Women should be wives and mothers and nurses and teachers, and you should only work until you get married and have kids.

My father was not happy when I chose to go to college. He certainly wasn’t happy when I chose to go into engineering. And he really believed that I would “come to my senses.” My two younger brothers are both engineers. My family’s business did something called ‘well servicing and abandonment’ – essentially keeping old wells in service or capping them off. It’s dirty, miserable work. Dangerous. It was very, very blue collar.

LN: Can you share one thing about yourself that most people probably don’t know?

DE: My kids are mortified, but I was a cheerleader in high school.

LN: Do you feel like now in some ways you’re a cheerleader for Sandia?

DE: I do! I’d like to think leadership can help motivate and encourage the very capable people here.

Sandia tests Salton Sea-grown algae as new fuel source and pollution solution

Imperial Valley Conservation Research Center's Jeanette Lucero helps operate Sandia's SABRE Project flowway. Algae grown in the system is visible in the foreground.
(Photo by Jules Bernstein)

The good, the bad, and the algae

By Jules Bernstein

Sandia is testing whether one of California's largest and most polluted lakes can transform into one of its most productive and profitable. Southern California's 350-square-mile Salton Sea has well-documented problems related to elevated levels of nitrogen and phosphorus from agricultural runoff. Algae thrives on these elements — a fact that causes environmental problems but could also be a solution to those problems.

Sandia intends to harness algae's penchant for prolific growth to clean up these pollutants and stop harmful algae blooms while creating a renewable, domestic source of fuel. Algae can be easily converted to fuels and chemicals using a Sandia Labs-patented fermentation process.

DOE's Bioenergy Technology Office (BETO) estimates the US can produce at least one billion tons of feedstocks for biofuels every year without any negative impact on the environment. That equates to about 25 percent of our nation's need for fuels that would not have to be imported. Amongst these feedstocks, algae are unique in that they grow exponentially: in other words, under the right conditions, doubling every day.

BETO is funding Sandia's Salton Sea Biomass Remediation (SABRE) Project because it will help determine whether algae can be a viable part of the solution to the nation's need for diverse energy sources.

Superior results

After only a few months, Sandia biochemist Ryan Davis (8614) is enthusiastic about the prospects. "The early results we're already getting from the Salton Sea appear to be superior to results from similar algae systems. It's really promising."

When state and local officials gathered by a tributary of the Salton Sea one bright, hot morning in late May, it was to mark the kickoff of the project's second phase. During the first phase, Sandia partnered with Texas A&M AgriLife Research to test whether a newer method of farming algae could be as productive as an older, more established method.

Traditionally, companies grow single species of algae in raceways — structures vaguely resembling small race tracks or giant bathtubs. The raceways produce algae well suited for making high-value nutritional products like spirulina or beta carotene, as well as other nutraceuticals. Raceways also offer growers a lot of control. But there are a few drawbacks. They are generally high maintenance, requiring trained technicians, expensive fertilizers, carbon dioxide, and high-quality water.

Additionally, an estimated 30 percent of production on algae farms can be lost each year due to pest-related pond

crashes. Sandia is currently doing research to minimize crashes, including testing strains of algae for resistance to various predators and diseases, and learning to detect the signs of an imminent pond crash.

The newer farming method is called an "Algal Turf Scrubber" flowway system, used for growing a collection of native algae species. To the untrained eye, the system looks like a free-standing rain gutter. It gurgles quietly as water is pulsed in waves across a sloped flowway. The algae consume the nutrients, and clean water emerges from the lower end.

The system operates using solar-powered pumps, requiring almost zero maintenance, except for periodic algae harvesting, which can be done using common farming equipment. Sandia designed the renewable power pump system that provides water to the flowway. The technology and components of the flowway were developed by a company called HydroMentia Technologies LLC.

A perfect fit

Based on early results of the testing in Texas, turf scrubbers can produce a quantity of algae comparable to raceways. And they are a perfect fit for

places with acres of inexpensive real estate, nutrient-rich water (no need for additional fertilizer), and tons of sun, like the Salton Sea.

The kind of turf system being tested for the SABRE Project has other, additional benefits. It is growing algae that is native to the area, so it is naturally more resistant to attacks from local pathogens and predators. The algae's thick texture also lends itself to easy harvesting.

One of the criticisms lobbed at algae as a bio-fuel source is that it uses too much water. Ryan refutes this criticism. "There's water and then there's water," he says. "We've shown that we can grow algae in turf scrubber systems using water full of nasty components. And it still thrives." In other words, there isn't much that can be done with this water until the pollutants are removed.

Algae blooms can grow so large they are visible from outer space, as is the case in Lake Okeechobee, Lake Erie, the Chesapeake Bay, and the Gulf of Mexico. Blooms are

not directly toxic to fish, but under certain conditions they can become harmful to marine and human life. When blooms die off, the decay process can leave waterways with "dead zones," low-oxygen areas that cause fish to suffocate. If ingested, certain harmful algae species can also cause flu-like symptoms in people and death in pets, according to congressional testimony.

Ag runoff feeds algae blooms

Algae blooms also occur in the Salton Sea, an accumulation point for all agricultural runoff water from one of the largest farming areas in the United States. Nitrogen, phosphorus, and other elements from fertilizers are continuously deposited into the Sea. The presence of these elements feed algae blooms, with negative consequences that can cascade throughout the ecosystem.

Thousands of asphyxiated, dead fish are visible on the shores of the Salton Sea each year. The smell has not done anything positive for businesses in the area, according to a study prepared by Tourism Economics for the Palm Springs Convention & Visitors Bureau. Additionally, studies suggest that the death of birds in the area may be related to strains of algae that produce toxins. "Release of untreated chemicals into open waterways has broad ecological impacts," Ryan says.

Ironically, farming algae could eliminate the harmful effects of unchecked natural algae growth. Water from one of the three major tributaries of the Salton Sea flows into the 900-foot SABRE Project turf scrubber. Algae growing inside the scrubber system feed on and remove the chemicals in the water as it passes through. As the water passes from the system back into the tributary, Sandia's team hopes the elements that kick-start algae blooms will have been removed in significant quantities.

Should the SABRE Project prove successful, it could provide a model of remediation for algae blooms nation-

wide. There are hopes that the Imperial Valley would benefit as well. By covering thousands of acres of dry, receding Salton Sea shorelines with algae crops, turf scrubber operations could reduce widespread air pollution from toxic dust. Algae refineries could also provide new economic opportunities.

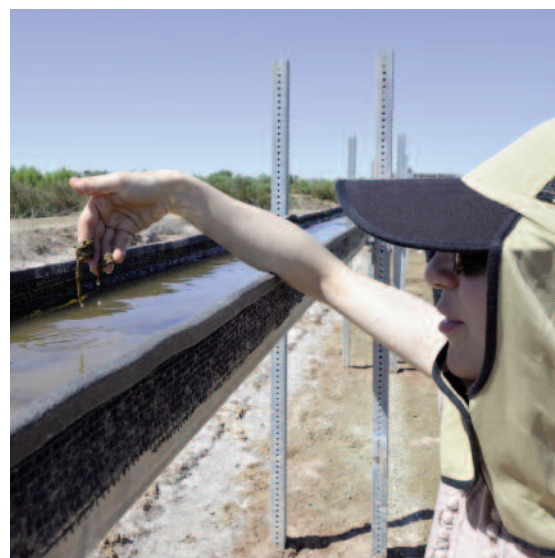
Sandia partnered with the Imperial Irrigation District (IID) to help get the SABRE Project off the ground. "A proponent of renewable energy and an advocate for the Salton Sea, the district believes projects like this have the potential to make a meaningful difference," says IID Officer of Media

Communications Specialist Marion Champion. "We are very hopeful that this project will yield good, clean renewable energy while providing a natural and safe process to remove chemicals, protecting area wildlife for generations to come."



SANDIA BIOCHEMIST Ryan Davis (8614, left) takes guests on a tour of the SABRE Project system.

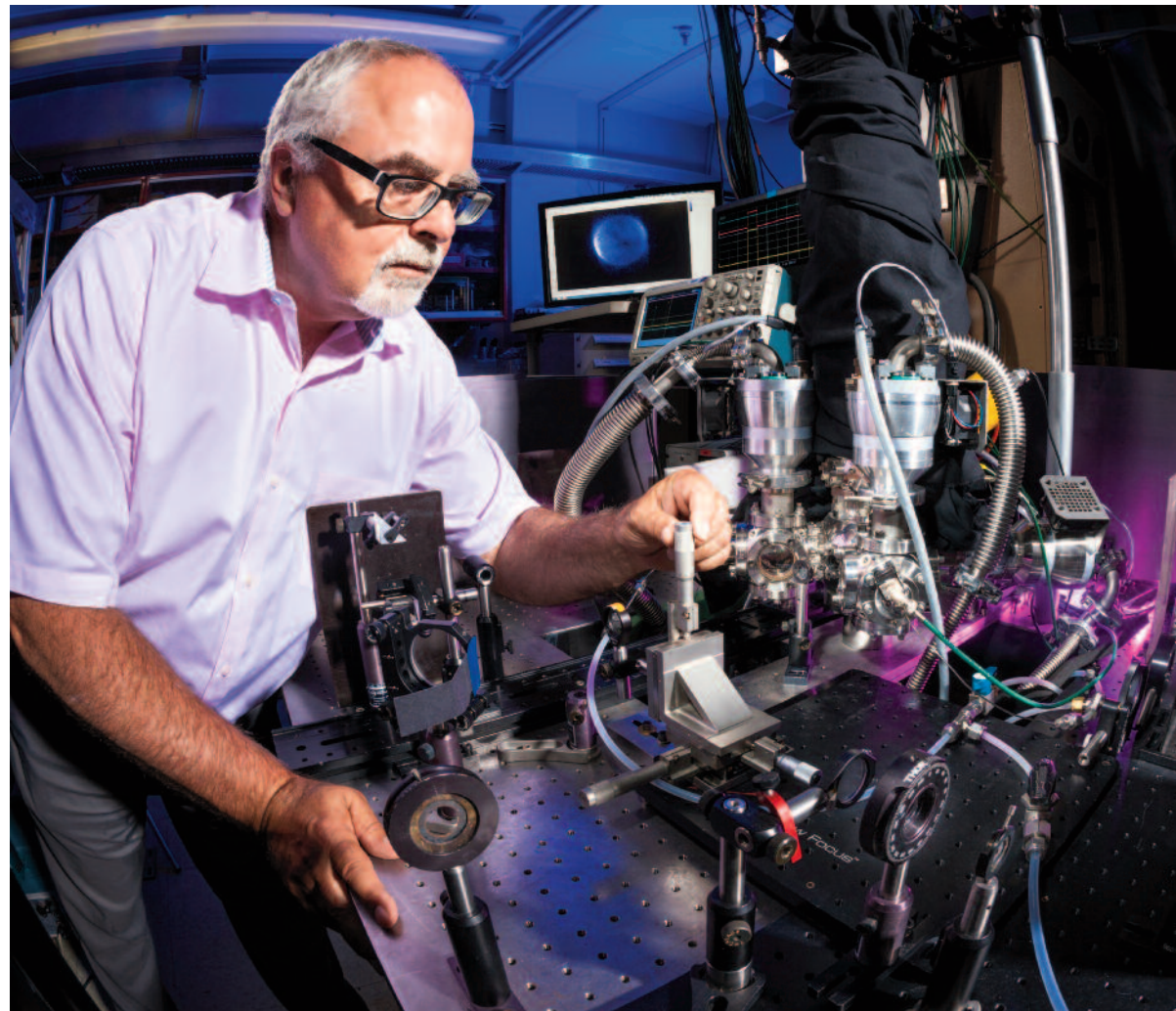
(Photo by Jules Bernstein)



SANDIA CHEMICAL ENGINEER Anthe George (8614) with a handful of benthic algae growing in the SABRE Project flowway system.

(Photo by Jules Bernstein)

Watching molecules move



AN EYE FOR MOLECULES — David Chandler adjusts equipment in his lab at the CRF. David has been conducting research on velocity-mapped ion imaging since the late 1980s. (Photo by Randy Wong)

By Michael Padilla

30 years ago, David Chandler (8300) built an apparatus at Sandia's Combustion Research Facility (CRF) to image the fragments of a molecule as it fell apart. At the time, David had no idea what a tremendous impact his research would have on understanding how molecules behave when excited by light or struck by another molecule or atom.

Since its first description in a 1987 publication coauthored by David and his collaborator, Prof. Paul Houston, this breakthrough research — first called photo-fragment imaging and now called, as the technique has evolved, velocity-mapped ion imaging (VMI) — has been referenced in almost 2,000 peer-reviewed, scientific articles. To celebrate the 30th anniversary of the VMI technique, the *Journal of Chemical Physics* has devoted a special issue in 2017 to VMI and has invited three guest editors: David, Houston, and Prof. David Parker of Radboud University.

The VMI technique makes it possible to take a picture of a fragmenting or a colliding molecule at a specific time. The apparatus used in VMI is essentially a velocity microscope for gas phase charged particles (electrons, atomic, or molecular cations or anions). Analysis of the image provides the speed and direction — that is, the velocity — of slowly moving charged particles.

VMI can be used to study any process that generates a slowly moving charged particle. A more difficult problem was measuring the velocity of slowly moving neutral atoms and molecules. Shining ultraviolet light on most neutral particles converts them into charged particles without changing their velocity. So VMI can also be used to measure the velocity of a slow-moving neutral particle after their conversion to charged particles. This was the first application of the technique by David and Paul.

Before VMI, determining the velocity of a neutral molecule required a very high-resolution laser and many measurements to obtain the same information David now acquires with a single VMI image. “The loss of an electron from a neutral molecule doesn't change its velocity because the electron weighs so little,” David says. “It's as if you were running down a

street. If a dime fell out of your pocket, you wouldn't suddenly accelerate. But if you had been carrying a bowling ball and dropped it, you would speed up.”

VMI used to study chemical processes

The VMI technique has been used to study many chemical processes, such as the dissociation and ionization of molecules excited by light. For example, photolytically ejecting an electron from a molecule produces a negatively charged electron and a positively charged atom or molecule. Each resulting charged particle's velocity can be measured with the VMI technique to provide information about this process. The imaging of the electron is a version of photoelectron spectroscopy. VMI can also examine molecular collisions that change the molecules' velocity and energy content or that directly create charged particles.

“With this technique we can determine the microscopic details of how molecules exchange energy when they collide,” David says. “This is a fundamental process that happens in reacting systems such as flames.

You have to understand this energy transfer process extremely well if you want to understand and predict how reactions happen at high pressures.”

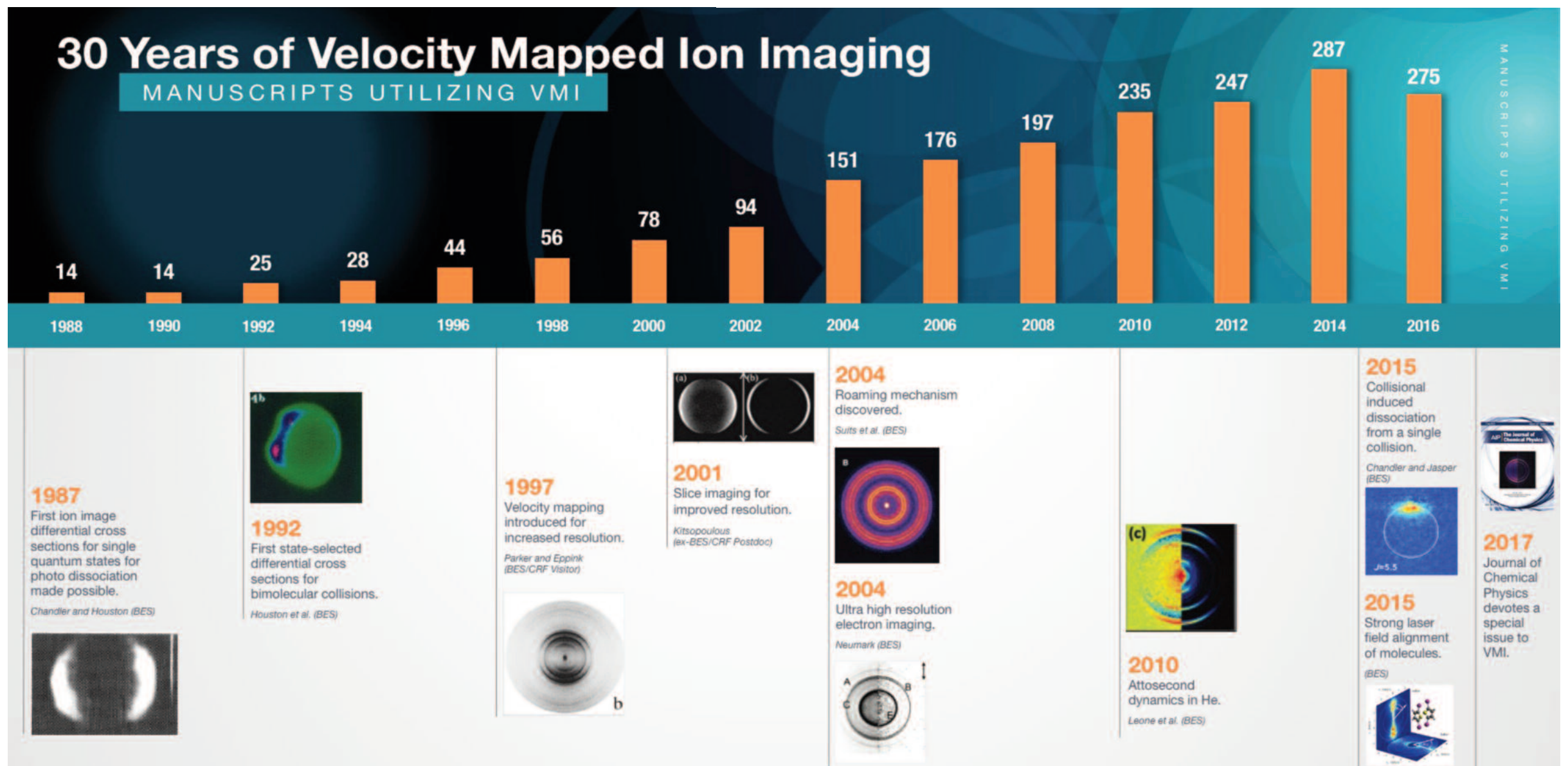
In addition to studying collisional energy transfer at the CRF, David has led CRF research efforts that focus on photochemistry and understanding how molecules dissociate — or fall apart — after being excited by light that has a greater energy than the energy of the molecule's chemical bond.

VMI has provided insight into both the process by which molecules fall apart and the energy of the broken bonds. For instance, one Sandia study measured the energy of the C-H bond in acetylene,

an important quantity needed for unlocking the acetylene combustion mechanism. David's use of VMI at Sandia has enabled a greater understanding of processes that underlie combustion, providing critical information for developing accurate, science-based combustion models.



FIRST SIGNAL — The first ion image made its debut appearance in a 1987 publication coauthored by David and his collaborator, Paul Houston. This breakthrough research, now known as velocity-mapped ion imaging, has been referenced in almost 2,000 peer-reviewed, scientific articles.



30 YEARS OF RESEARCH — David Chandler first invited Paul Houston to Sandia's Combustion Research Facility in 1986 to conduct research on the photochemistry of the methyl iodide molecule. Here they are in 1986 and 2010.



“We look at how much energy is transferred in a single collision and the directions in which the two molecules involved in the collision recoil,” David says. “Additionally, we use the polarization properties of lasers to determine how the molecule spins and vibrates as it recoils from the collision. Does a molecule spin like a Frisbee, act like a propeller, or turn a cartwheel as it bounces off of another molecule?”

1980s: Research begins

When David began his career in photochemistry at Sandia/California in 1982, there was great interest in researching nitrogen oxide chemistry (NOx). During this period, his roommate and colleague, Robert Perry, found that adding the HNCO molecule to exhaust gases removed NOx pollutants from the process.

“Through photochemistry, we learned about the energetics of the bonding of the HNCO molecule. HNCO reacts with nitrogen oxides at pretty low temperatures to make water, carbon dioxide, and nitrogen,” says David. “Photochemistry allowed us to better understand the bonding within the HNCO molecule and therefore contributed to the understanding of how the molecule reacts to get rid of NOx pollutants.”

At a photochemistry meeting in 1986, David presented his HNCO work and heard a talk by Prof. Paul Houston, who was then at Cornell University. During the talk, it occurred to David that there was a better way of measuring the velocity of the products of photochemistry. David invited Paul to the CRF to conduct research on the photochemistry of the methyl iodide molecule. The first paper demonstrating the ion imaging technique in 1987 was a result of that collaboration.

After leaving Sandia, Paul performed, at Cornell, the first experiments that used ion imaging to study bimolecular collisions. He crossed a beam of NO molecules and a beam of argon atoms. He then observed how the NO molecules recoiled from the argon.

“It was like holding two water hoses spraying at each other, except they were gas hoses,” David says. “About 99 percent of the time, the molecules in one beam pass right through the other beam without colliding. But every once in a while, a collision occurs, resulting in some energy transfer.”

Those excited molecules are detected by ionization from an ultraviolet-colored laser beam and then imaged by an ion imaging apparatus.

Because laser beams are used to produce ionization of the neutral products, properties such as beam polarization and color are critical for understanding the process being studied. For instance, different colors of laser light can detect molecules that have varying amounts of rotation or vibration. A laser beam polarized in one way may detect molecules that are spinning clockwise, while a laser beam polarized in another way may identify counterclockwise-spinning molecules. Such measurements are of great interest to theoretical chemists who try to predict the behavior of atoms and molecules when they collide or are born in a photochemical process.

1990s: Improving the apparatus

“In the late 1990s, Dave Parker (Professor at UC Santa Cruz and later at Radboud University) worked with me at the CRF learning to conduct ion imaging,” says David. “After he returned to his university in the Netherlands, he made a really big improvement to the apparatus by adding a high-

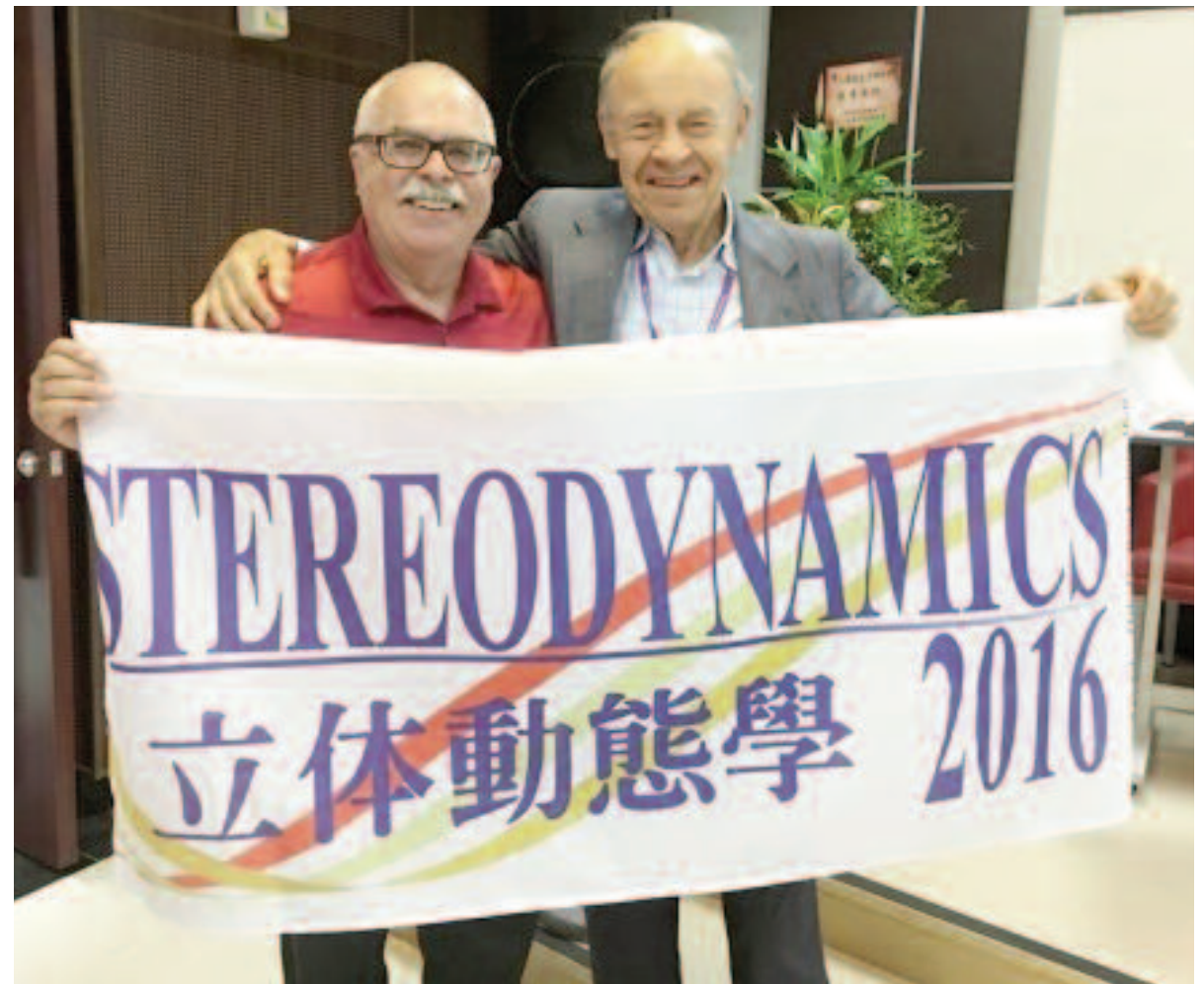
resolution electrostatic lens.” This higher resolution allowed researchers to measure the speed of charged particles with greater precision, thereby providing new information on processes that had previously been studied. It was after this improvement that the ion imaging technique became known as the Velocity-Mapped Ion Imaging technique.

Over the years, researchers have modified and improved ion imaging in various ways. One popular variation is the “slice-imaging” technique, pioneered by one of David's ex-Sandia postdoctoral fellows, Theofanis Kitsopoulos. In this variation of the VMI technique, the detector is turned on and then off very quickly so that only a portion of the moving atoms or molecules is detected. This technique can simplify the analysis of some problems.

VMI today

Currently, David uses VMI to investigate the laser alignment of the H₂ molecule with the strong electric fields associated with laser beams. He is also studying the collisional energy transfer of very vibrationally excited molecules. These molecules, which are excited by a laser beam to an energy where they are almost falling apart, dissociate after a single collision provides a small kick of extra energy. David is ionizing the fragments and measuring their velocity with the ion-imaging apparatus to learn about the energy kick.

The primary funding source for David's VMI work is DOE's Basic Energy Sciences office through the Gas Phase Chemical Physics program.



INTERNATIONAL AWARD — In honor of his work developing and using the velocity-mapped ion imaging technique to study stereochemistry, David Chandler, left, was the 2016 recipient of the Bernstein Award at the 15th International Stereodynamics meeting in Taiwan. Here is David with Nobel laureate Dudley Herschbach at the meeting.

(Photo courtesy of David Chandler)

InterSpec: Quick, accurate, integrated radiation analysis

Software helps determine source, type, and amount of radiation in real time

By Michael Padilla

When law enforcement officers and first responders arrive at an emergency scene involving radiation, they need a way to swiftly assess the situation for safety. Having analysis tools that can quickly and reliably make sense of radiation data is of the essence.

Decision makers in these scenarios can now turn to a new Sandia-developed tool called InterSpec. A software application available for both mobile and traditional computing devices, InterSpec can rapidly and accurately analyze gamma radiation data collected at the scene.

A comprehensive, easy-to-use radiation analysis tool

Software developer and physicist Will Johnson (8646) says InterSpec updates, strengthens, and integrates many radiation analysis tools and resources into a single mobile or desktop application that is seamless and intuitive to use.

“InterSpec allows decision makers to rapidly identify both radioisotopes and shielding materials around the source,” Will says. “InterSpec is also a valuable tool for laboratories and other academic and industrial settings where an accurate understanding of detected radiological material is crucial.”

For the past four years, Sandia researchers have been working to make InterSpec easy to use in any situation by anyone who works with radioactive material. The Sandia team consists of Will, Ethan Chan and Edward Walsh (both 8646), and Noel Nachtigal (8766).

InterSpec was created to be used by individuals who have some radiation knowledge but aren’t necessarily experts. In many situations, radiation experts are not immediately available to assist law enforcement personnel and emergency responders. Using InterSpec, even individuals with limited analysis experience can obtain the detailed radiation information they need to make quick decisions, reducing their dependence on radiation experts, as well as the experts’ analysis loads.

“You can take the radiation data from any detector, and InterSpec will identify the radiation source and calculate the radiation dose,” Edward says. “InterSpec will also tell you if it’s dangerous for you to be around this source. The tool is amazing.”

Multi-platform tool with more features and a larger database

InterSpec provides quick, useful radiation analysis by coupling radiation physics, radiation transport calcula-



REAL-TIME RADIATION ANALYSIS — Researchers Ethan Chan, Alf Morales, and Will Johnson demonstrate how InterSpec is used in the field. (Photo by Dino Vournas)

tions, detector response functions, and a radioisotope database that is much larger than those found in similar products. These attributes enable InterSpec to rapidly compute quantities of interest, reducing user errors.

Unlike radiation analysis software packages that are limited to Windows systems, InterSpec runs on multiple platforms, including Windows, Mac OSX, Linux, iOS, and Android, and on all web browsers.

The wide range of platforms means that users in different settings can quickly exchange data and share a unified view of the data. Furthermore, InterSpec works in isolated or shielded environments with no network connectivity needed.

“We’ve made InterSpec as easy as possible to use,” says Ethan. “You don’t have to spend two or three years to learn the tool. InterSpec is really simple, both in how it looks and how you use it.”

InterSpec features include work tracking, the ability to view and edit metadata, a help function, and automatic saving of spectrum files. The spectrum files

include location-embedded metadata for visualization on a map, so users can select a geographical region of measurements to sum for spectral analysis.

First-time users can access InterSpec’s help system, as well as tool tips that describe each button’s function. In addition, intuitive icons enable users to move around the app quickly.

Using InterSpec in the field

Will serves on a DOE team tasked with identifying various types of radiation found throughout the country.

“The goal of the team is to figure out if detected radiation is a threat or not,” he explains. “InterSpec helps determine if an item is a potential threat, and if so, what kind.”

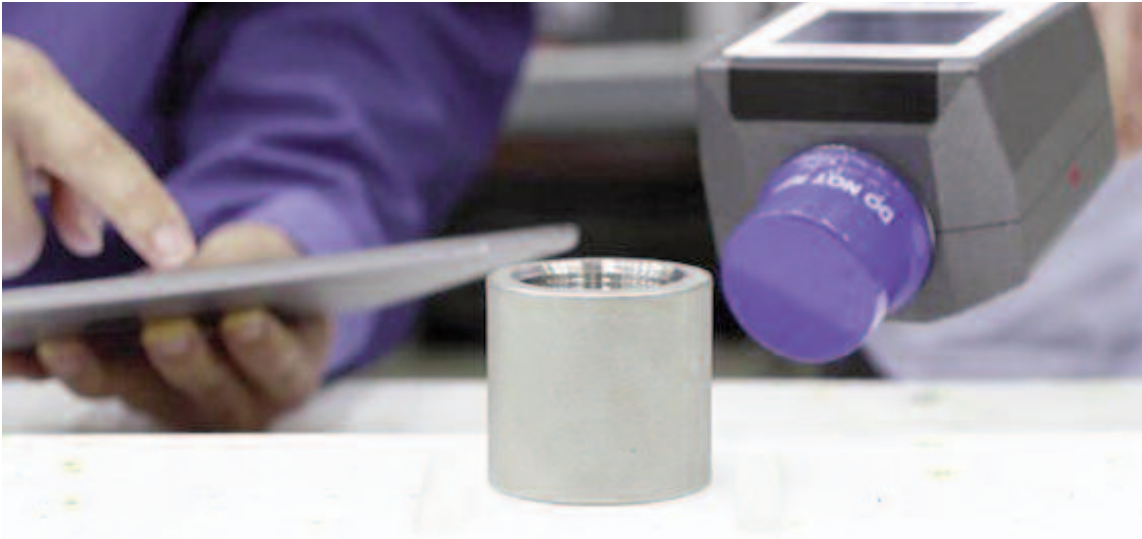
Will says InterSpec has helped the team respond to actual events in the field. “The ability to analyze data before reaching a traditional computer or in situations where only a phone or tablet could be taken has proved extremely useful.”

“InterSpec can be used to help determine the source nuclide type, strength, and shielding inside sealed boxes or cargo containers,” Will says.

The Sandia team is working to make InterSpec available to people who conduct radiation measurement analysis so that they can benefit from the improved workflows, capabilities, and time savings of InterSpec.



AVAILABLE FOR BOTH MOBILE and traditional computing devices, InterSpec can quickly analyze gamma radiation data.



INTERSPEC FEATURES include work tracking, the ability to view and edit metadata, and a help function.

InterSpec focuses on the following:

- **User experience.** InterSpec’s user interface is designed to minimize user mistakes, while enabling the rapid determination of answers. Many tools and dynamically generated reference information are available to assist users in exploring radiation data.
- **On-the-fly nuclide aging.** By accounting for differences in the gamma-energy spectrum as nuclides age, InterSpec can determine the original date of production for some nuclides. This information can aid forensics investigations in estimating source mass or activity.
- **Identification of photopeaks.** Photopeaks, the Gaussian-shaped regions in gamma-energy spectra, indicate the gamma-ray energies emitted during nuclear decay. InterSpec includes an extensive photopeak energy database that enables users to analyze data from multiple, or less commonly encountered, isotopes.
- **Resolution of overlapping photopeaks.** When determining source strength and shielding, InterSpec automatically resolves overlapping photopeaks that have been contributed by multiple isotopes.
- **Shielding.** By revealing the amount and type of shielding between the radioactive source and the detector, InterSpec allows analysts to determine the strength of the source, rather than simply the strength of the detected radiation.
- **Deeper radiological understanding.** InterSpec provides users with information about unstable isotopes, the composition of different isotopes.

Biofuels from bacteria

Sandia Labs helps HelioBioSys understand new clean energy source

By Jules Bernstein

You might not cook with this sugar, but from a biofuels standpoint, it’s pretty sweet.

A Bay Area company has patented a group of three single-celled, algae-like organisms that, when grown together, can produce high quantities of sugar just right for making biofuels. Sandia is helping HelioBioSys Inc. learn whether farming them on a large scale would be successful.

The demand for clean, domestically produced, renewable energy has resulted in a lot of research on algae. Algae is a desirable biofuel source because it doesn’t compete with food crops for land, water, or other resources. The water used to grow algae is not usually suitable for agriculture. Typically, algae farms aim to produce large quantities of biomass so that they can then be harvested and converted into fuels, chemicals, or other bio-based products.

By contrast, HelioBioSys is working with organisms called cyanobacteria. Until the early 1900s, they were mistaken for algae. Like algae, colonies of cyanobacteria grow in water and have incorrectly been referred to as “blue-green algae.” But unlike algae, these marine cyanobacteria excrete sugars directly into the water where they grow. A lot of it.

According to Sandia biochemist Ryan Davis, a typical algae operation might grow one gram of biomass per liter (0.04 ounces per quarter gallon). Small-scale testing on these cyanobacteria shows they can produce four to seven grams of sugar per liter of biomass (up to 0.25 ounces per quarter gallon), an improvement in concentration of up to 700 percent. Therefore, growing cyanobacteria for sugars is more efficient than growing biomass.

Competitive with petroleum

Filtering sugar from water is a much simpler and therefore less expensive process than extracting lipids from large quantities of algae mass. Sugar is easy, compared to biomass, to convert into a wide variety of chemicals and fuels. Furthermore, cyanobacteria do not require additional fertilizer to make their sugars. These cost savings could make biofuels competitive with petroleum.

But first, this group of cyanobacteria’s phenomenal sugar production needs to be better understood so that it can be maximized. “In other words,” Ryan says, “we’re trying to deconstruct the magic sauce in this cyanobacteria consortium and learn what conditions are optimal for large-scale growth.”

HelioBioSys founders Rocco Mancinelli and David Smernoff say they chose to grow a community of three



SANDIA RESEARCHERS, left to right, Eric Monroe (8614), James Jaryenneh (8623), and Tyler Eckles (8614) operate the raceways growing a consortium of cyanobacteria. (Photo by Jules Bernstein)

cyanobacteria rather than focus on a single organism (which is common in algae cultivation) because communal systems more closely resemble nature. They say cyanobacteria in communities are stronger and more likely to survive changes in the environment, contamination, and predation. Sandia is helping them test this idea.

The cyanobacteria have already proven successful in closed, controlled, sterile laboratories. Sandia researchers are now growing the cyanobacteria in large raceway systems that resemble long bathtubs. Though the raceways are indoors they are open to the air, so predation could prove a much bigger challenge.

Ryan says, “Giant bowls of sugar water generally don’t last long in nature.” However, this is where Sandia’s expertise in algae cultivation could be helpful, he says. “We can understand where we can prevent bacterial overload, and stop the sugars from being consumed by things we don’t want to grow.”

Unlike true algae, cyanobacteria have the remarkable ability to “fix” nitrogen from the atmosphere, which helps support their growth. This means cyanobacteria can literally pull their own fertilizer out of the air, eliminating the need for costly additional fertilizers.

Ryan and his team are trying to understand whether each of the three cyanobacteria primarily performs a specific function for the consortium, such as fixing the

nitrogen or producing most of the sugars. Even though the cyanobacteria require sunlight for growth, Ryan thinks one of the cyanobacteria could be primarily responsible for acting like a sunscreen, protecting the group against light levels that get too high.

Sandia also is evaluating other attributes, such as micronutrient requirements or whether there are certain triggers for sugar production that could be controlled.

If the work at Sandia is successful, the next step is to test the cyanobacteria outdoors in larger ponds. After proving the technology outdoors, HelioBioSys hopes to license or sell the technology.

Special DOE program makes collaboration possible

Mancinelli and Smernoff are both microbiologists with remarkable backgrounds. They were colleagues at NASA, where they worked on systems that could support human life extraterrestrially. With HelioBioSys, they’re now working on clean energy systems that could have positive environmental impacts that support human life here on Earth.

Despite their impressive history and mission, they say that without DOE’s Small Business Vouchers pilot program, getting cyanobacteria-based sugars to market would be unlikely. “Raising the funds for us to do the research that Sandia can do, with their equipment and facilities and expertise, would otherwise be impossible,” Smernoff says. “So to have this program and let a small company like ours access those resources is invaluable.”

As a result of the program, HelioBioSys has also partnered with Lawrence Berkeley National Laboratory. The laboratory has agreed to deploy its tangential flow filtration unit in Sandia’s test beds. The unit is essentially a box with a porous membrane that only allows molecules of a certain size to pass through it. This will allow Sandia to quickly separate and extract sugars from the marine water.

Additionally, the Berkeley laboratory is studying the viability of these sugars for conversion to biofuels. In addition to biofuels, sugars produced by marine cyanobacteria have the potential to be used as the source material for a long list of products that are currently derived from petroleum. These include plastics, pharmaceuticals, fabrics, nylon, adhesives, shoe polish, asphalt, roof shingles, and more.

As this project draws to a close by year’s end, the nation could be closer to a sweet future powered by the oldest of microorganisms.

COHERENT

(Continued from page 1)

alternative theoretical models.

David Reyna, manager of Remote Sensing Dept. 8648 at Sandia’s California laboratory, was instrumental in the COHERENT experiment. David spearheaded a 2012 workshop at Sandia that brought together leaders and researchers in the neutrino field. David and Sandia researcher Belkis Cabrera-Palmer (8647) also oversaw the deployment of multiple detectors at ORNL as part of the COHERENT collaboration.

“We have a long history at Sandia of investigating low-energy neutrino detection techniques with potential applications to reactor monitoring,” says David. “For many years we have been working with the community on the development of low-threshold germanium detectors for potential Coherent elastic neutrino-nucleus scattering detection.”

One-of-a-kind research facility

Belkis was in charge of analyzing three years of neutron background data collected with the Sandia-developed neutron scatter camera in five different locations across the SNS, a one-of-a-kind research facility that produces neutrons in a process called spallation.

“Fast turnaround of the analysis results guided the collaboration in deciding the location with background low enough to allow for detection,” says Belkis.

David and Belkis also supported the initial deployment of a High Purity Germanium Detector in collaboration with Lawrence Berkeley National Laboratory. Currently, David and Belkis are working on the deployment

of a Sandia-developed high-energy neutron detector, the Multiplicity and Recoil Spectrometer, for the project. Belkis will lead the deployment, simulation, and analysis of the detector, which is scheduled to continuously collect and monitor neutron background data at the SNS for the next five years.

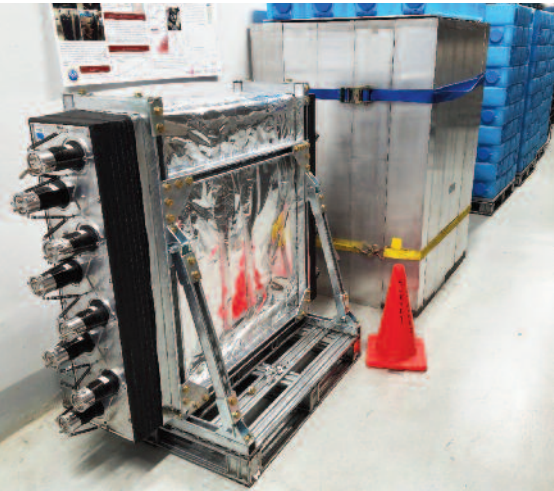
David says Sandia has leveraged its extensive expertise in fast-neutron detection in its ownership of the neutron background measurements for the COHERENT collaboration. Originally supported by an exploratory Laboratory Directed Research and Development project in 2013, Sandia was able to make the critical initial measurements in the basement of the SNS that established the viability of the experiment.

The SNS produces neutrons for scientific research and also generates a high flux of neutrinos as a byproduct. Placing the detector at SNS a mere 65 feet (20 meters) from the neutrino source vastly improved the chances of interactions and allowed the researchers to decrease the detector’s weight to just 32 pounds (14.5 kilograms) of cesium-iodide. In comparison, most neutrino detectors weigh thousands of tons. Although they are continuously exposed to solar, terrestrial, and atmospheric neutrinos, they need to be massive because the interaction odds are more than 100 times lower than at SNS.

Not just interesting to theorists

Typically, neutrinos interact with individual protons or neutrons inside a nucleus. But in coherent scattering, an approaching neutrino sees the entire weak charge of the nucleus as a whole and interacts with all of it.

The calculable fingerprint of neutrino-nucleus interactions predicted by the Standard Model and seen by COHERENT is not just interesting to theorists. In nature,



THE DETECTOR on the left is the Sandia module for neutron monitoring. The adjacent box is the shielding enclosure for the cesium-iodide detector that produced the results reported in *Science*.

it also dominates neutrino dynamics during neutron star formation and supernovae explosions. In addition, COHERENT’s data will help with interpretations of measurements of neutrino properties by experiments worldwide. The coherent scattering can be used to better understand the structure of the nucleus.

Though the cesium-iodide detector observed coherent scattering beyond any doubt, COHERENT researchers will conduct additional measurements with at least three detector technologies to observe coherent neutrino interactions at distinct rates, another signature of the process. These detectors will further expand knowledge of basic neutrino properties, such as their intrinsic magnetism.

Emergency exercise

‘Officer is down! We are going to need assistance....’
Violent simulations prepare first responders for the real thing

By Jules Bernstein • Photos by Dino Vournas

It was a morning like any other at Sandia’s California laboratory, until it wasn’t. A woman and her ex-husband were arguing in a parking lot as other employees did their best to ignore the former couple. She abruptly walked away from him toward the Bldg. 904 auditorium. Moments later, the agitated ex-husband picked a fight with a nearby security officer. Elsewhere on campus the urgent message broadcast over Protective Force radio: “Officer is down! We are going to need assistance. . . .”

Thus began the first of several scenarios that played out during the early hours of June 8. Extremely detailed emergency simulations complete with actors, makeup, fake blood, bulletproof vests, and weapons gave personnel from multiple security agencies the chance to practice coordinating their response to mass casualty situations.

Emergency Management coordinator John Norden (8511) says this was the first such exercise to involve Sandia/California’s Protective Force and volunteer Community Emergency Response Team as well as outside agencies including Lawrence Livermore National Laboratory’s Protective Force, the Livermore Police Department, and the Alameda County Fire Department. The effort took four months of planning both within Sandia and with external partners.

The entire response team performed admirably, John says. “Our guys caught up with me before I could even think! Everyone was highly focused on the mission,” he says. Though communications can sometimes pose a challenge when agencies are used to using slightly different emergency terminology, John says they were able to coordinate effectively. “I have every confidence we’re prepared for an emergency should it arise.”

Spread throughout Bldg. 904 with impressively realistic head wounds, approximately 20 Sandians volunteered for a second scenario involving active shooters. Two armed men stormed the auditorium, where an assembly was gathered. Moments

later, Protective Force officers with weapons burst through the doors and sonic fire-works erupted as gunfire was exchanged.

Responders had to make split-second decisions about whether to shoot in a room filled with people. Gunshot “victims” wore special vests that track laser tag hits and allow teams to review which weapon shot which person, and where.

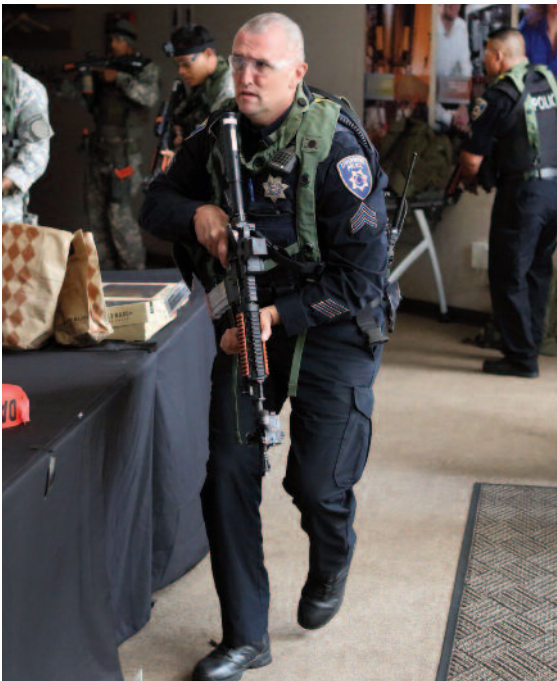
“This was a great opportunity for us to test our emergency response on every level without interruptions or any actual injuries,” John says. In addition to giving Protective Force officers an opportunity to practice applying life-saving measures to a fellow officer and coordinating with outside agencies, this exercise was a test of California’s incident command procedures.

An incident commander responds immediately to an emergency scene, assesses what’s happened, establishes a centralized command post, and calls for additional responsive services such as medical technicians or hazardous material cleanup crews. Essentially, this person helps prevent chaos during high-adrenaline situations. In Livermore, the Protective Force functions as the campus incident commander.

Gunshot victim volunteer and Logistics Operations Manager Patrice Sanchez (8523) says she, like John, feels more confident because of the exercise, and she thinks others should volunteer for future simulations if they can. “Participating makes you think about the reality of what’s going on in the world and the possibility that you could be a part of it,” Patrice says. “You shouldn’t be paranoid but you should be prepared.”

The next big drill, Urban Shield, is a 48-hour, full-scale test of the Bay Area’s regional emergency response capabilities, policies, organization, equipment, and training. It kicks off at 5 a.m. on Sept. 9 and ends on Sept. 11. The ending date is not a coincidence. The Urban Shield exercise began as a collective response to the Sept. 11, 2001, terrorist attacks in New York and Washington, D.C.

In October there will also be a site-wide drill on the California campus to help employees be prepared in the event of an earthquake. For more information about security and emergency resources, visit the Security Operations website or call (925) 294-1226.



From pinprick to prognosis in 15 minutes

Sandia adds HIV and tuberculosis to rapid medical testing system SpinDx

By Jules Bernstein

In less time than it takes most people to find their lost keys, Sandia’s SpinDx system can now simultaneously detect dozens of diseases including HIV and tuberculosis.

In a proof-of-principle study, Sandia scientists have demonstrated this SpinDx capability for the first time in a laboratory. Not only can the four-pound lab-on-a-disc system determine whether a patient has a current HIV or TB infection, it can determine whether a patient has ever been exposed to these illnesses.

Differentiating between latent and active infections is significant because it allows doctors to determine whether aggressive treatment measures are warranted.

Partnership enables progress

The SpinDx system evolved from earlier protein detection work conducted at Sandia by Sandia biochemist Chung-Yan Koh (8621) and his team. SpinDx already had the ability to detect an incredibly diverse portfolio of public health problems, including food-borne bacteria, toxins, markers of biological attacks, and levels of radiation in blood samples.

This work demonstrating HIV and TB detection using SpinDx was made possible through a grant from the National Institute of Allergy and Infectious Diseases and a collaboration with the University of Texas Medical Branch in Galveston.

Clinicians at the university were interested in new technology for rapid diagnosis of HIV and TB. They shared real patient samples that had already undergone several types of tests. Chung-Yan, working with the university’s Dr. Julia Litvinov and others, looked to see whether SpinDx could produce the same results as these prior tests, and it did.

“We are very fortunate that here in the United States tuberculosis is not very widespread. Because of this, out of the thousands of patients that move through the university hospital system we were only able to find three patient samples in two years that tested positive for both HIV and active infection with tuberculosis,” says Chung-Yan.

Smaller, more efficient

Although the ability to test for HIV and TB already exists, lab tests show SpinDx can do it less expensively, more quickly, and more reliably than the existing tests performed separately.

SpinDx looks and functions a bit like a DVD player. A disposable disc can send drops of raw, unprocessed biological samples into as many as 64 different channels that function, according to Chung-Yan, “like dozens of tiny test tubes.” The disc spins, and the samples interact with test chemistry or reagents inside the channels. If there is a reaction between the sample and the reagents, it will occur in about 15 minutes.

Part of the reason SpinDx can give such rapid read-outs is because its tests take place in extremely small spaces.

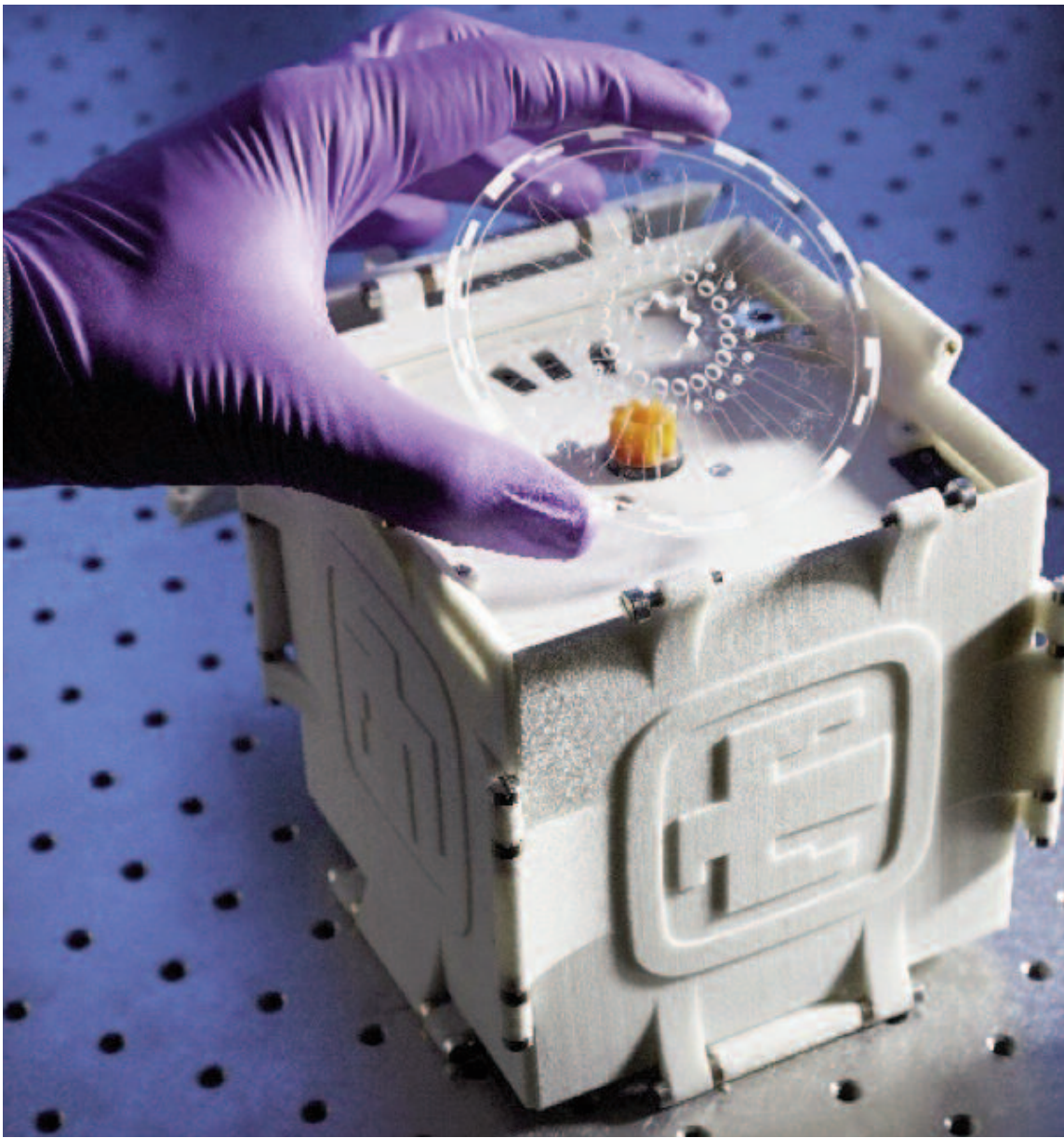
“By confining the space in which elements interact, things happen faster,” Chung-Yan explains. “You’re going to find a missing friend in a coffee shop a lot faster than you’re going to find them in a football stadium.”

Smaller space also means the system requires less sample. Typically, Chung-Yan says a doctor’s office will draw about three milliliters of blood. SpinDx only requires about 2 microliters. That is more than a thousand times less blood. One finger stick is sufficient to run any number of tests on the disc.

Microbeads allow major testing advantages

One common way to test for HIV and TB is through an enzyme-linked immunosorbent assay (ELISA) test. The ELISA technique can detect both active and previous exposure to illnesses, and is highly sensitive. The test uses antibodies, which are proteins manufactured by the immune system in response to infections.

In an ELISA test for an active illness, a slide is prepared with specific antibodies fixed to it. If the sample blood contains virus proteins, they will bind to the antibodies and give off a signal. In an ELISA test for signs of previous exposure to an illness, the slide would be prepared with antigens — proteins of a pathogen such as HIV or TB. The test would look for signs that antibodies in the blood have attached to the test antigen. At later stages of infections, when viruses have disappeared



A PORTABLE MICROFLUIDIC DISC like the one shown here enables SpinDx to simultaneously test for multiple diseases. (Photo by Jeff McMillian)

from the blood, the antibodies that flushed them are still detectable, making this a good way to diagnose previous exposures.

Though SpinDx uses an ELISA-type test, there is a key difference. ELISA test plates must be washed in between steps to prevent antibodies from sticking to elements in the blood that aren’t their targets. This labor-intensive requirement results in tests that take approximately three hours. SpinDx channels use microbeads in place of plates, and materials that filter out unwanted elements in the blood sample. No washing or sample preparation is required.

Similarly, polymerase chain reaction (PCR) tests are highly effective at disease detection. However, this method is also more labor intensive than SpinDx. PCR requires the extraction of DNA or RNA from a sample, then repeatedly heating and cooling the sample to cause any viral DNA/RNA to multiply to detectable levels.

“Typically, PCR tests are done in big clinical labs. They require highly skilled people with large machines. The robots that perform ELISAs in clinical labs are bigger, more complex, and even more expensive than PCR. We’ve been miniaturizing and simplifying testing processes for field use with SpinDx,” Chung-Yan says.

Better than eyeballs

Another key difference between SpinDx and other testing methods is the way results are indicated. Commonly used lateral flow tests are similar to home pregnancy tests: they require the application of a biological sample to a strip of paper pre-treated with antibodies. If the test antibodies bind to HIV or TB protein in the sample, the paper displays a color.

Smear tests, which are the gold standard for diagnos-

ing TB in the field, similarly rely on the naked eye to detect pathogen presence. Smear tests require technicians to look for mycobacteria in phlegm samples under a microscope.

If there is a reaction in a SpinDx test, a red laser causes the tip of the microchannel to glow, signaling the presence of an infectious agent. The lasers interact with computer algorithms to determine a positive or negative result. When connected to a computer, SpinDx also supplies information about the amount of virus in a sample. The lasers and algorithms are inherently more sensitive than unaided vision alone.

Next steps

Now that Chung-Yan’s team has demonstrated these abilities in the laboratory, he says the next step is to test the system with more patient samples over a longer period of time. This will boost confidence in the reliability of SpinDx results for HIV and TB detection. “While our initial results are very encouraging, it is important to note that we tested only three patient samples and hence, more work needs to be done,” Chung-Yan says.

Commercial partners have licensed SpinDx technology in the past for widely different uses including male fertility tests, monitoring public water supplies for pathogens, and testing for drugs of addiction. Chung-Yan says he hopes that new partners will take the technology, mature the tests to move beyond proof-of-concept, and use it for disease detection in areas with limited resources.

“HIV and TB are still big public health concerns, and they’re hitting hardest in places that have the least ability to respond,” Chung-Yan says. “By making fast, mobile reliable detection methods more accessible we hope to have a positive impact on the problem.”

* * *

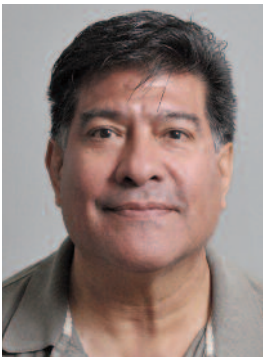
This work was supported by the National Institute of Allergy And Infectious Diseases of the National Institutes of Health (NIH) under Award Number R01AI098853. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

Mileposts



New Mexico photos by
Michelle Fleming

California photos by
Randy Wong



Chris Flores

402521



Gil Herrera

351000



Steve Kempka

355810

Recent Retiree





Duane Lindner

398000



David Turner

351352



Kim Denton-Hill

305820



Dan Golling

308737



Tracy Walker

308554



Nancy Martinez

253641



Tammie Muniz

259353



Gus Potter

256815



Peter Schultz

251444



Dru Sitges

2510738



Sean Winters

252600



Steve Dron

205426




Colin Smithpeter

202240



Mat Celina

151853



Linda Chance

156522



Keith Clements

152556



Jose Fernandez

155196



Saskia King

152582



Harry Kuykendall

155196



Trevor Le Pay

1510746



Jared McLaughlin

152610



Marie Myszkier

1510222



James Overfelt

151443



Jeff Pankonin

155352



Nick Pattengale

155824



Kenneth Pohl

152358



Tom Polachek

15627



Sean Rager

154745



Daniel Sandoval

152617



Jamieann Sirois

154748



Barbara Zimmerman

158240

Active for Life's top 2017 steppers



WHEN THE 13TH ANNUAL Active for Life Challenge came to an end last month, the champion contestants at Sandia's California lab included Brandon Heimer (8712) in first place with 856,439 steps, Brooke Harmon (8623) in second place with 762,205 steps, and Torri Rinker (8621) in third with 746,034 steps. Here, top 2017 steppers Carolyn Fisher (8623), left, and Torri Rinker (8621) pose with their Active for Life Challenge trophies. Carolyn and Torri placed fifth and third, respectively.

(Photo by Madeline Burchard)

SANDIA CLASSIFIED ADS

MISCELLANEOUS

POWER MOBILITY CHAIR, never used, \$800 OBO. Salazar, 505-873-0680, weekdays, 6-8 p.m., ask for Marcos.

AEROLETTE MILK FROTHER, hand-held, battery operated, Green Lane Products, UK, hardly used, in original box, \$11. Wagner, 505-504-8783.

STORAGE CABINETS, w/ad-justable shelves, one 36" x 24" x 72", five 36" x 18" x 72", \$275 ea.; portable refrigerated air conditioner, De-Longhi, used 2 weeks, \$400. Tomlin, 505-259-9695.

AMERICAN GIRL DOLLS, \$65 OBO; and accessories plus other 18-in. doll items, call/email for list. Coverdale, 286-2664, slave2a3@q.com.

DRESSER, antique, Tiger Oak, good condition, \$350 OBO. Diaz, 505-821-0868.

DIGITAL PIANO, Yamaha Clavino-va CLP-170, full-size graded hammer keyboard, bench, w/manuals, \$750. Delker, 913-205-9825.

EXTENSION LADDER, aluminum, 10-ft., \$35; wooden step ladder, 6-ft., \$15. Marchi, 265-6211.

GALVANIZED STEEL CONTAIN-ERS, heavy-duty, w/lids & handles: 6-gal., \$20; 4-gal. \$15, \$30/both. Cocain, 550-8484.

DROP-LEAF TABLE, 48-in. diame-ter, Pottery Barn, Shayne-style, w/4 Napoleon chairs, white, \$600. Krok, 626-676-1052.

ELLIPTICAL, FreeMotion, model 515, 1 owner, low miles, fea-tures fan, incline, iFit, sound system, \$400 OBO. Brothers, 505-401-6140.

WHEELCHAIR/SCOOTER POWER LIFT, for Toyota Sienna mini-van, very good condition, user manual, remote control. Roberts, 453-6743, danskis@live.com.

MINIATURE DACHSHUND PUP-PIES, located in Sandoval Co. Gallegos, 239-1799, ask for Liz.

GRAND PIANO, Kawai KG-2D, 5'10", ebony, w/soundboard humidifier, \$7,000. Harris, 410-490-2440.

VACATION RENTAL, Mexico (Cabo, Puerto Vallarta, Can-cun), min. stay 4 nights, 60-90 advance notice. Carrasco, 505-803-3831.

WASHER & DRYER, LG, TROMM, 3.2-cu. ft. washer, 8-cyl. dry-er, white, excellent condition, \$500. Meinelt, 350-3255.

MOTORCYCLE TRAILER, 2002 Kendon stand-up, 3-rail, dirt bike/sport bike, \$1,000. Levenhagen, 505-280-5507.

SNOWBOARD BOOTS, winter is coming, men's, Burton, used gently, size 8, \$50, size 9, \$25. Muhlberger, 505-362-8731, send text.

DESK, Tema, w/matching filing cabinet, white, 64" x 29-1/2", w/chair, \$75. DuBay, 268-0307.

SOFA, micro suede, 8-ft., great condition, \$200 OBO. Williams, 280-2181.

SOUR DOUGH STARTER, bring large container, free. Nelson, 881-0148.

MOTORCYCLE JACKET, First Gear Kilimanjaro, women's medi-um, red/black, removable zip-in liner, excellent used condition, \$35. Jensen, 821-2373.

MICROSOFT SURFACE PRO 3, Intel Core i7-4650U, 265 GB HD, 8 GB RAM, keyboard, \$560. Glover, 505-715-1678.

OFFICE CHAIR, Mayline, black w/armrest, mesh back, model RT3BB, adjustable, excellent condition, \$45. Wagner, 505-504-8783.

SECTIONAL COUCH, Ashley Toletta, 1 yr. old, brown, 7-pc., great condition, \$1,400 OBO. Ellenberger, 661-932-5236.

SLATE POOL TABLE, Murrey, 4' x 8', w/cues, cue stand, balls, cover, ping-pong table top, great condition, \$400. Wampler, 299-4910.

ROLL-TOP DESK, photos avail-able, must pick up, \$300 OBO. Massoth, 505-980-9944.

TRANSPORTATION

'91 HONDA ACCORD, 4-dr., white w/blue interior, Honda dealer serviced, Michelin tires, gas-saver, perfect condition, \$5,000. Behar, 821-9299.

'04 SUBARU WRX, 2.0 Turbo, AWD, blue, roof rack, 161K miles, good condition, main-tenance records, \$8,500. Burr, 505-974-9285.

'97 FORD EXPEDITION XLT, 4x4, needs AC & tune-up, other-wise good, 131K miles, \$2,000 OBO. Urrea, 980-7316.

'00 NISSAN ALTIMA, 80K miles, \$2,500 firm. Neidigk, 822-0203.

'99 VW CABRIO, 5-spd. manual, 165K miles, good shape, runs well, \$3,200. Brunt, 505-294-8220.

'02 JEEP WRANGLER SPORT, 6-cyl., 5-spd., loaded, Dana 44, white, tan interior, 177K miles, \$6,500. Eilers, 286-4013.

'93 FORD F150 XLT, 4x4, Super-cab, 5.0L, V8, AT, AC, cruise, tilt, alloy wheels, rear slider/camper, original owner, 128K miles, passed emissions, \$3,350. O'Toole, 382-6051.

'99 SUBARU OUTBACK, manual transmission, silver, black cloth, 102K original miles, \$1,650. Rockwell, 505-250-3737.

'05 FORD EXCURSION, diesel, rare, lots of upgrades, beauti-ful, excellent condition, call/text for photos, \$21,000. Dukes, 505-604-0615.

'05 SILVERADO Z71, crew cab, 4x4, 81K miles, excellent orig-inal condition, NADA \$15,650, asking \$14,600 OBO. Martin, 623-687-7673.

'64 CHEVELLE MALIBU SS, 400ci, small block power-glide trans-mission, PW, \$19,500 OBO. Sivage, 505-259-7115.

'00 TOYOTA CAMRY LE, V6, 195K miles, \$2,100. Rice, 515-6261.

'08 DODGE MAGNUM, runs great, \$5,200 negotiable. Brewster, 505-238-4704.

'04 FORD F150 LARIAT, super-crew, 2WD, 5.4L Triton V8, tow pkg. w/transmission cool-er, new battery, 144K miles w/new tires (<1K miles), \$8,900. Provencio, 520-891-3895.

'04 PONTIAC GRAND AM, V6, red, 109K miles, excellent condition, \$2,500. Givler, 505-715-2081

RECREATION

RALEIGH MESIKA TRAIL BIKE, Ladies 15, blue, 3 yrs. old, used only 5 times, \$400 OBO. Orndorff, 505-796-2082.

GIANT MOUNTAIN BIKE, tech area transport, lives outside, regular maintenance, set up as commuter, retiring, \$250 OBO. Crain, 265-1006.

'13 TRIUMPH THRUXTON, w/fly shield, ~500 miles, like new, oil changed 3 times while breaking in, \$8,000. Abeyta, 505-573-8195.

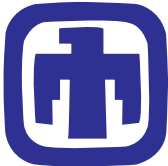
REAL ESTATE

4-BDR. HOME, 3 baths, w/loft, 2,700-sq. ft., near park & bike path, Cabezon/Rio Rancho, \$320,000. Ramos, 972-951-0290.

4-BDR. HOME, 2-1/2 baths, Northern Meadows, \$175,000. Woltman, 757-335-0106.

WANTED

GOOD HOME, Cockatiel, 7 yrs. old, male, w/cage. Evanoff, 821-0654.



How to submit classified ads

DEADLINE: Friday noon before week of publication unless changed by holiday.

Submit by one of these methods:

- EMAIL: Michelle Fleming (classads@sandia.gov)
- FAX: 844-0645
- MAIL: MS 1468 (Dept. 3651)
- INTERNAL WEB: From Techweb search for 'NewsCenter', at the bottom of that page choose to submit an ad under, 'Submit an article'. If you have questions, call Michelle at 844-4902. Because of space constraints, ads will be printed on a first-come basis.

Ad rules

1. Limit 18 words, including last name and home phone (If you include a web or e-mail address, it will count as two or three words, de-pending on length of the address.)
2. Include organization and full name with the ad submission.
3. Submit ad in writing. No phone-ins.
4. Type or print ad legibly; use accepted abbreviations.
5. One ad per issue.
6. We will not run the same ad more than twice.
7. No "for rent" ads except for employees on temporary assignment.
8. No commercial ads.
9. For active Sandia members of the workforce, retired Sandians, and DOE employees.
10. Housing listed for sale is available without regard to race, creed, color, or national origin.
11. Work Wanted ads limited to student-aged children of employees.
12. We reserve the right not to publish any ad that may be considered offensive or in bad taste.

Endless curiosity takes Montana mustang on a wild ride

By Jules Bernstein

Quick quiz: what do a wildlife biologist, Arabic language scholar, and a Sandia systems analyst have in common? Answer: they are all the same man, Andrew Kosydar (8714).

Andrew had a rocky start as a foster youth in Portland, Oregon. He failed out of high school and started living on his own while he was still a teenager. The young man spent several years doing odd jobs, trying to decide where to go and what to do with his life.

A love of nature drew him to Montana. There he thrived. He established residency, finished high school, and enrolled at the University of Montana. Andrew shot to the top of his class while earning dual degrees in French and wildlife biology. Along the way he collected an impressive number of prestigious academic awards and honors, including Goldwater, Udall, and Fulbright scholarships.

Fast forward, and Andrew earns his PhD in biology, receives stamps from more than 50 countries on his passport, and speaks five languages. He goes to work for the Army, researching human behavior and designing curriculum for the Army logistics university on culture and foreign language. He moves on to work for California Assembly member Tom Daly before finally being recruited to join Sandia.

His accomplishments en route to Sandia's California campus are impressive by any standard, all the more so when considered against the backdrop of his challenging childhood. By some estimates, only about 3 percent of kids who have lived in foster care ever go on to graduate from college. Part of what has helped Andrew beat the odds is the approach he takes to learning.

He thinks, therefore he is

Discourse on Method, written by René Descartes in 1637, articulates a theory of learning that most closely parallels Andrew's own. This is the treatise in which Descartes wrote the famous phrase, "I think, therefore I am," as a way to confront the ultimate doubt that one exists at all.

The work goes on to describe what we now call the scientific method. The most important part of Descartes' argument, according to Andrew, is essentially that you don't know something is true until you've seen it more than once.

Andrew says that the scientific method is so fundamental, he spends the first several weeks of most classes he teaches on it and makes the *Discourse* required reading. "I feel as though we're often walking around with our eyes wide shut, not questioning things that we believe to be true," he says. "Being a good scientist means being open to all possibilities."



ANDREW KOSYDAR has traveled to more than 50 countries, speaks five languages and spent years after dropping out of high school doing odd jobs before going on to earn a PhD in biology. "He's always asking questions — the right questions," says his manager. (Photo by Jules Bernstein)

Sheryl Hingorani (8710) recruited Andrew last year in large part because she believed his history of finding evidence-based solutions to problems would serve Sandia's national security mission. This belief has proven to be correct. "In his time at Sandia, Andrew has found multiple creative ways to deal with complex issues," she says. "His unbiased approach is evident in his work."

Andrew's manager Todd West (8714) agrees. He says it is Andrew's unusual background and his outlook that makes him such a valuable team member. "He's always asking questions — the right questions. His perspective is refreshing," Todd says.

Giving back

Having moved past the challenges of his earliest years, Andrew is passionate about helping others to move past problems.

To that end, he has a record of community service nearly as extensive and varied as his professional work history. A Boren Fellowship

in graduate school allowed him to live and study in Syria. Andrew now serves as a mentor to other program fellows.

He also volunteers in Sacramento, where he lives with his wife, for the Department of Housing and Urban Development's biennial Point-in-Time count. Data from this national county-by-county tally is used to fund homelessness prevention programs and supportive services. Somehow, he has also found time to judge elementary school science competitions and do environmental advocacy work.

"I am really motivated to give back to my fellow human beings on as large a scale as I can, and not just take from this beautiful planet that we have," he says. In this motivation he also resembles Descartes, who believed generosity is the highest virtue.

Though Montana is not where Andrew was born, he has a lot in common with the wild mustang horses in his alma mater's state. Allowing his mind to roam free has led to a personal and professional life full of adventure. Learn more about where he's been and where he is going by following him at goo.gl/oZZcg9.

Learn about three families at the California Laboratory

Service runs in the family

By Madeline Burchard
Photos by Krissy Galbraith

The California Laboratory is often described as one big family. In addition to being a tight-knit community, the site is also home to many literal families. Learn about three of them and how they came to be.

The Hansen-Oteri-Sandovals

In 1970, 16-year-old Robert Sandoval (8546) was approached by one of his teachers with a job opportunity at Sandia through Livermore High School's "Work Experience Program."

"I didn't know what Sandia was, but I thought it was worth a try," Robert recalls. "The day of my interview, I biked from school to the lab in 106-degree heat. I had to stop a few times on that ride, but something inside



ROBERT SANDOVAL, Angelina Hansen, Danielle Oteri, and Albert Sandoval.

of me told me to keep going. I'm so happy I did. As soon I started working at Sandia, I knew I would be here for life." What started out as a casual interview has now become a 45-year career. Nearly a year after graduating high school, Robert was hired into the Reclamation Department. He then entered a plumbing apprenticeship. He currently works as a technologist processing work activity permits within the project and construction management organization.

Angelina Hansen (8516) and Danielle Oteri (8200) joke that they were born at Sandia. Their summers were spent swimming at the Lawrence Livermore National Laboratory pool, which closed in June 2004, and joining their family members for lunch at the LLNL café, which was outside of the guard gates at that time. In addition to their uncle Robert, first cousin once removed Albert

Sandoval also works at Sandia and their father Adam Sandoval retired from Sandia in 2016. Adam joined Sandia after Robert encouraged him to apply. Adam continued the tradition by enlisting other family, including Albert.

One of the proudest moments of Robert's career was taking his daughter to Bring Your Daughters to Work Day and introducing her to former Center 8500 Director Pat Smith.

"I was so happy to share Sandia with my daughter and introduce her to the people I worked with," Robert says.

When jobs opened that fit Danielle and Angelina's skills, their uncle Robert and their father encouraged them to apply.

"I want the people I love to be at places that help them grow," Robert says. "Sandia is one of those places."

Danielle started in 2000 as a custodian and Angelina joined the ES&H department in 2005. Both echo Robert that Sandia is a place where people can evolve and grow. Before reaching her current role as senior man-

agement assistant, Danielle worked as a security officer, CAS operator, security training coordinator, and badge office assistant. Angelina began her career in 2005 providing administrative support to Environmental Safety and Health and Division Assurance before converting to a full time employee in 2012 and a records management professional in 2015. Danielle and Angelina say they'll encourage their children to carry on the family tradition.

"We all joke around and laugh together and we genuinely care about each other. No one is a stranger," Angelina says.

"When my kids are grown, I want them to consider Sandia."

Michele Lyon and Lexi Hart

When Michele Lyon (8522-1) first stepped onto the California Laboratory campus, it felt like a homecoming.

"Sandia reminded me of the environment and people I loved when I worked at Hewlett Packard," Michele says. "The California site has a casual and friendly atmosphere that was easy to join."

In 2010, Michele was working at a local call center



LEXI HART with her aunt, Michele Lyon.

and was yearning for the friendly culture and people she had enjoyed during her 27 years in different roles at Hewlett Packard, including as a training coordinator. Carol Lewis (8522-1), a former HP colleague, told Michele about an opening in Sandia's human resources group as an administrative assistant. She interviewed and accepted the offer to join the team. When the training coordinator position opened up, she made the transition from administrative assistant to training coordinator, a role she was already very familiar with.

"The people were what brought me to Sandia. Well, that and the amazing 9/80 schedule," she says. "My first Friday off felt surreal."

Several years later, Michele noticed that her niece, Lexi Hart (8744-1), had a natural talent for electronics. Lexi regularly volunteered to set up the audio and visual

equipment for events at their church. When a student position opened in the human resources group, Michele encouraged Lexi to consider it.

"I didn't really know where Sandia was or what it did," Lexi recalls. "I'm glad I went for it. The HR group spent a lot of time training and mentoring me."

Lexi's gift for computers and electronic equipment led to her reputation as the team's technology guru. In 2015, she made the leap to the videoconferencing group as a full-time contractor. As tough as it was to leave her old group, she quickly found community in her new team.

"I was happy to discover that the camaraderie and mentorship I received in HR was also found in my new group," Lexi says. "Sandia is a great place for an early career person. Everyone genuinely wants to see you succeed and will go out of their way to help. My more experienced colleagues often invite me to shadow them on assignments. I also can't imagine anywhere else where senior leadership would even know my name."

Lexi is currently working on an IT degree from Southern New Hampshire University.

The Yangs

In 2002, after working at the Institute for Defense Analysis, Lynn Yang (8716) began exploring joining Sandia's technical staff. As the daughter of Nancy Yang (8341), she saw first-hand how happy her mother was working at Sandia. So she, and others, were surprised when Nancy recommended she apply to Lawrence Livermore National Laboratory instead.

"My mother was so worried about any perceived conflict of interest that she asked me to apply to



LYNN YANG and her mother, Nancy Yang.

Lawrence and get experience there," Lynn says. "She wanted people to judge me on my own merits and accomplishments."

Nancy was proud of Lynn's academic accomplishments and she didn't want her relation to another member of the technical staff to be a distraction during the interview process. Her colleagues saw things differently.

"Len Napolitano [former CIO and then-Acting Director of Computer Sciences and Information Systems] asked me why I would send someone so qualified to Lawrence and jokingly questioned where my true loyalties were," Nancy says. "Later [former Div. 8000 VP] Mim John reinforced Len's sentiment. They didn't see our being related as an issue at all. If anything, they seemed taken aback that I would hesitate to bring my family here."

Nancy Yang began her career at Sandia in 1989 as a staff scientist. Going from industry to a national laboratory was a welcome change of pace. The focus on real-world impact and national mission motivated her to invest herself into her work. She has worked hard to pass down these values to Lynn.

"Sandia attracts families because the motivations of people drawn to work here are values that are often cultivated in the family — service, selflessness, and humility," Lynn says. "I was raised to honor those values. It felt natural that if my mother worked somewhere that allowed her to live her values, then I would also be attracted to that place."

Nancy and Lynn cite their experiences representing Sandia externally as the highlights of their careers. Nancy has given several talks at naval schools on Sandia technology. Lynn points to her opportunity to brief the National Security Council at the White House on the nation's ability to recover following a potential biological weapon attacks as the highlight of her career so far.

Sandia/California Gives Back

Every year, Sandians make a positive impact on the communities where they live and work. Check out the highlights of our 2016 giving below.

One Warm Coat

220 Coats

to Family Life Center at Tri-Valley Church of Christ

Make a Difference Day

75

pounds of tomatoes picked

35

metal posts pulled out of the ground

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